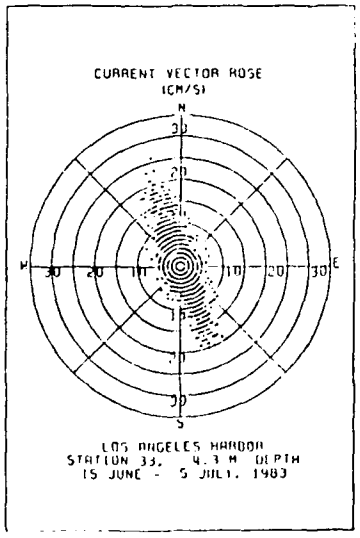
US Army Corps of Engineers



COASTAL ENGINEERING RESEARCH CENTER

MISCELLANEOUS PAPER CERC-89-4

(2)

LOS ANGELES AND LONG BEACH HARBORS MODEL ENHANCEMENT PROGRAM

Current, Tide, and Wind Data Summary for 1983

by

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Coastal Engineering Research Center

DEPARTMENT OF THE ARMY
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March 1989
Final Report

Prepared for US Army Engineer District, Los Angeles
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19 ABSTRACT (Continue on reverse if necessary and identify by block number)

Los Angeles and Long Beach Harbors share a common breakwater system which encloses one of the largest harbor systems in the world. In response to the expansion of ocean-borne world commerce, the Ports of Los Angeles and Long Beach are conducting planning studies for harbor development in coordination with Los Angeles District (SPL). The Coastal Engineering Research Center (CERC) acquired current and tide data in Los Angeles and Long Beach Harbors from 1 June to 3 August, 1983, from the National Oceanic and Atmospheric Administration (NOAA). Wind data from Long Beach Airport were also obtained. The data were analyzed and used to examine effects of wind on tidal circulation.

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PREFACE

This report was prepared by the Coastal Engineering Research Center (CERC) at the US Army Engineer Waterways Experiment Station (WES) and is a product of the Los Angeles and Long Beach Harbors Model Enhancement (HME) Program. This program has been conducted jointly by the Ports of Los Angeles and Long Beach, the US Army Corps of Engineers, Los Angeles District (SPL), and WES. The purpose of the HME Program has been to provide state-of-the-art engineering tools to aid in port development.

This investigation was conducted by personnel of CERC at WES during June 1987 to October 1988. The study was under general supervision of Dr. James R. Houston and Mr. Charles C. Calhoun, Jr., Chief and Assistant Chief, CERC, respectively; and under direct supervision of Mr. C. Eugene Chatham, Jr., Chief, Wave Dynamics Division (CW) and Mr. Douglas G. Outlaw, Chief, Wave Processes Branch (CW-P), CERC. Data were obtained from the Circulatory Surveys Branch, National Oceanic Survey.

Prototype data were reduced and analyzed and this report prepared by Mr. Ernest R. Smith, Hydraulic Engineer, CW-P. Ms. Lee Ann Germany, CW-P, CERC, typed this report, and Ms. Shirley J. Hanshaw, Information Products Division, WES, edited this report.

Commander and Director of WES during the study was COL Dwayne C. Lee, EN; Technical Director was Dr. Robert W. Whalin.

CONTENTS

CONVERSION FACTORS, NON-SI TO SI (METRIC)
UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
Fahrenheit degrees	5/9	Celsius degrees or kelvins*
feet	0.3048	metres
feet per second	30.48	centimetres per second
knots	1.852	kilometres per hour
miles	1.6093	kilometres
miles per hour	1.6093	kilometres per hour
pounds per square feet	0.000488	kilograms per square centimetres
pounds per square inch	14.5	millibars

* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: $C = (5/9)(F-32)$. To obtain Kelvin (K) readings, use $K = (5/9)(F-32) + 273.15$.

LOS ANGELES AND LONG BEACH HARBORS
MODEL ENHANCEMENT PROGRAM

Current, Tide, and Wind Data Summary for 1983

PART I: INTRODUCTION

Background

1. Los Angeles and Long Beach Harbors are adjacent, but separate, harbors located on the southern California coast in San Pedro Bay. The ports share a common breakwater system which encloses one of the largest man-made harbor systems in the world.

2. In response to the expansion of oceanborne world commerce, the Ports of Los Angeles and Long Beach are conducting planning studies for harbor development in coordination with the US Army Corps of Engineers, Los Angeles District (SPL). Our ports are a natural resource, and enhanced port capacity is vital to the Nation's economic well-being. In a feasibility study being conducted by SPL, the Ports of Los Angeles and Long Beach (LA-LB) are proposing a well-defined and necessary expansion to accommodate predicted needs in the near future. The Corps of Engineers (CE) will be charged with responsibility for providing deeper channels and determining effects of this construction on the local environment. Examination of field data is required to determine effects of wind on tidal circulation.

3. The Coastal Engineering Research Center (CERC) acquired 1983 current and tide data in Los Angeles and Long Beach Harbors from the National Oceanic and Atmospheric Administration (NOAA). Wind data from Long Beach Airport also were obtained. Locations of current meter and tide gage stations are shown in Figure 1.

Objective

4. The purpose of this report is to describe prototype current, tide, and wind data obtained for Los Angeles and Long Beach Harbors for examining the effects of wind on harbor circulation. The data also can be used for numerical model calibration of the harbors.

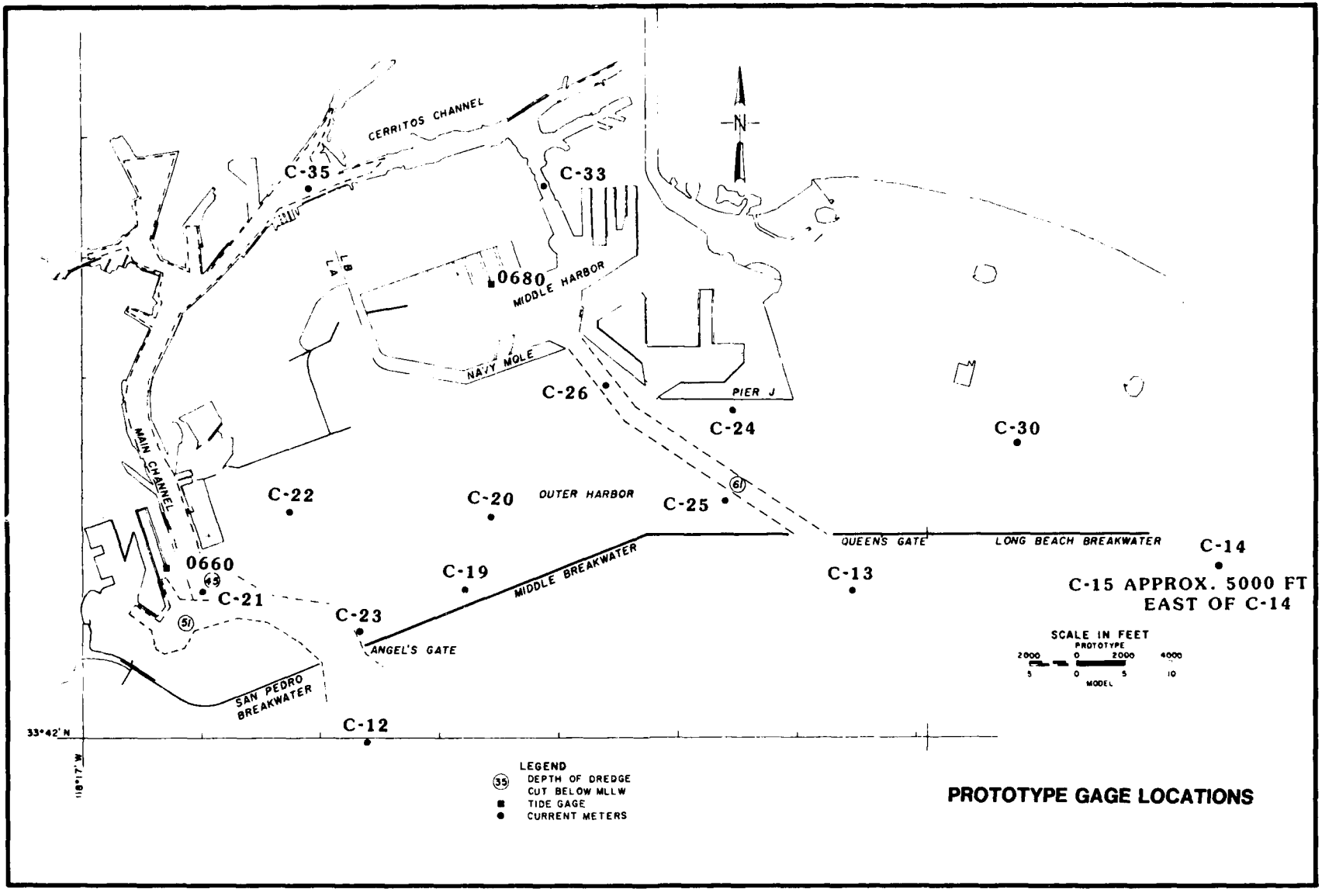


Figure 1. Location of current meters and tide gages

PART II: DATA REDUCTION AND ANALYSIS

5. Current, tide and wind data are archived in ASCII files and are available on request.

Current Data

6. Current data were collected from fifteen stations during the period 1 June - 3 August, 1983. Each station included one, two, or three current meters placed at different depths, usually surface, mid-depth, and bottom. Not all meters collected data continuously during the two months. Periods of operation for each meter are shown in Figure 2.

7. Data were sampled by Aandera current meters approximately every ten minutes. Data included direction in which the current was flowing (degrees from true north), current speed (centimeters per second, cm/s), temperature (degrees Celsius), pressure (kilograms/cm^2, kg/cm^2), and conductivity (millimhos/cm, mmho/cm). Other information consisted of; station number, current meter serial and reference numbers, ship name, first and last Julian date of data collection, water depth at the station (meters, m), sensor depth (m) below mean low water (mlw), and the observed time of sampling.

8. Data were presented as rose plots and stick vector plots. Rose plots were made for every current meter. Speed and direction to the flow were converted to U (positive north) and V (positive east) components. Speeds greater than 35 cm/s were set equal to this maximum value, and speeds less than 2 cm/s were removed to avoid cluttered data in the center of the plot. Since flow in the back channels and inner harbor was small, an upper limit of 35 cm/s was selected to view data on a rose. Current rose plots are presented in Appendix A.

9. Current vector plots were made for every station. All current meters at the station were plotted collectively over a seven day period. Water depth at the station is shown on the vertical axis and vectors were plotted on a horizontal base line representing the scaled depth of the current meter. Appendix B contains all current vector plots.

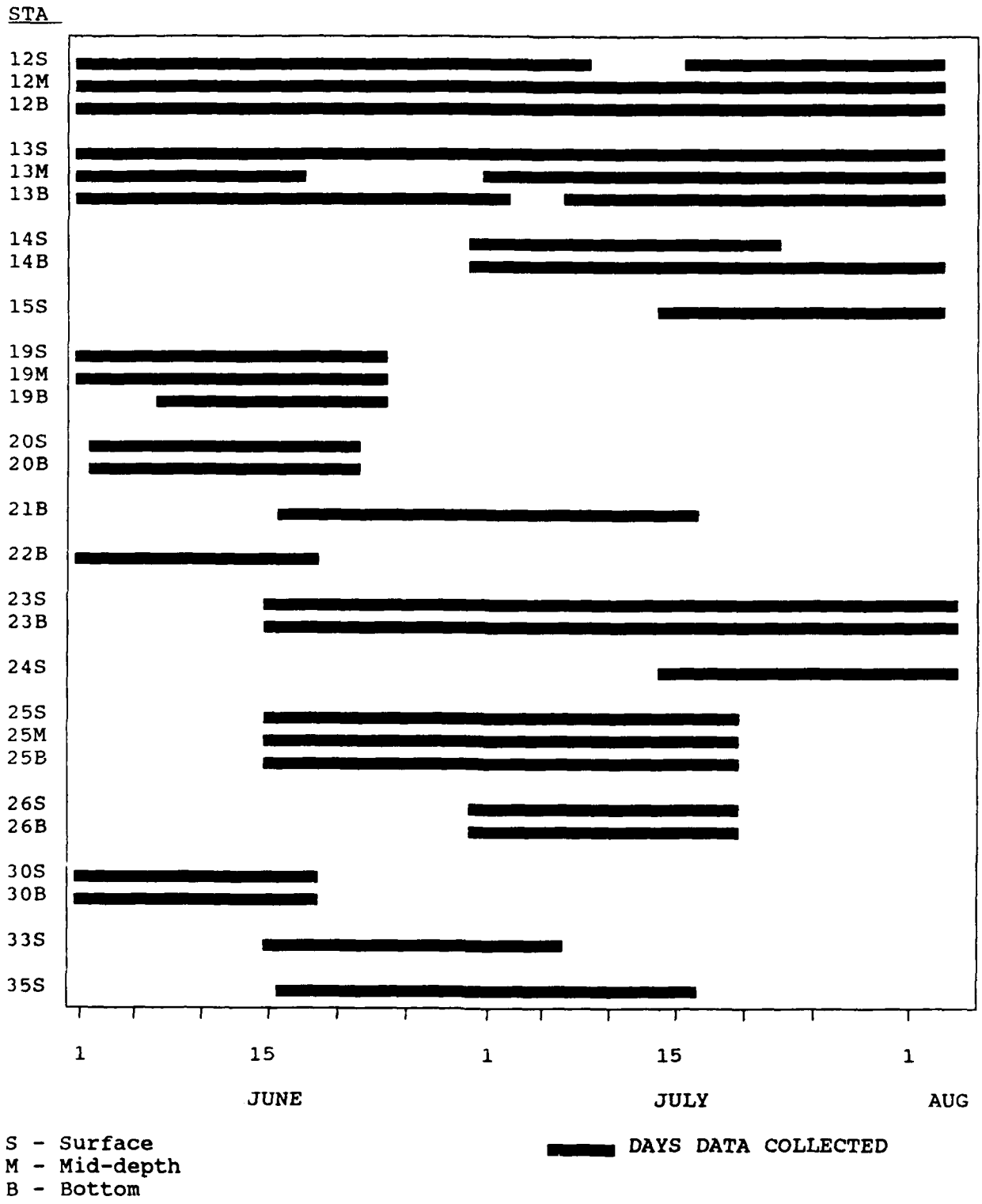


Figure 2. Current velocity data collection, 1 June - 3 August, 1983

Tidal Elevation Data

10. Tidal elevation data were obtained during May and June, 1983 from tide stations 0680 (Long Beach) and 0660 (Los Angeles Berth 60). Water elevations were measured in feet (ft) hourly. Other data included daily high and low water elevations and time of occurrence.

11. Water elevation corrected to mlw versus time over seven day intervals for each station is plotted in Appendix C.

Wind Data

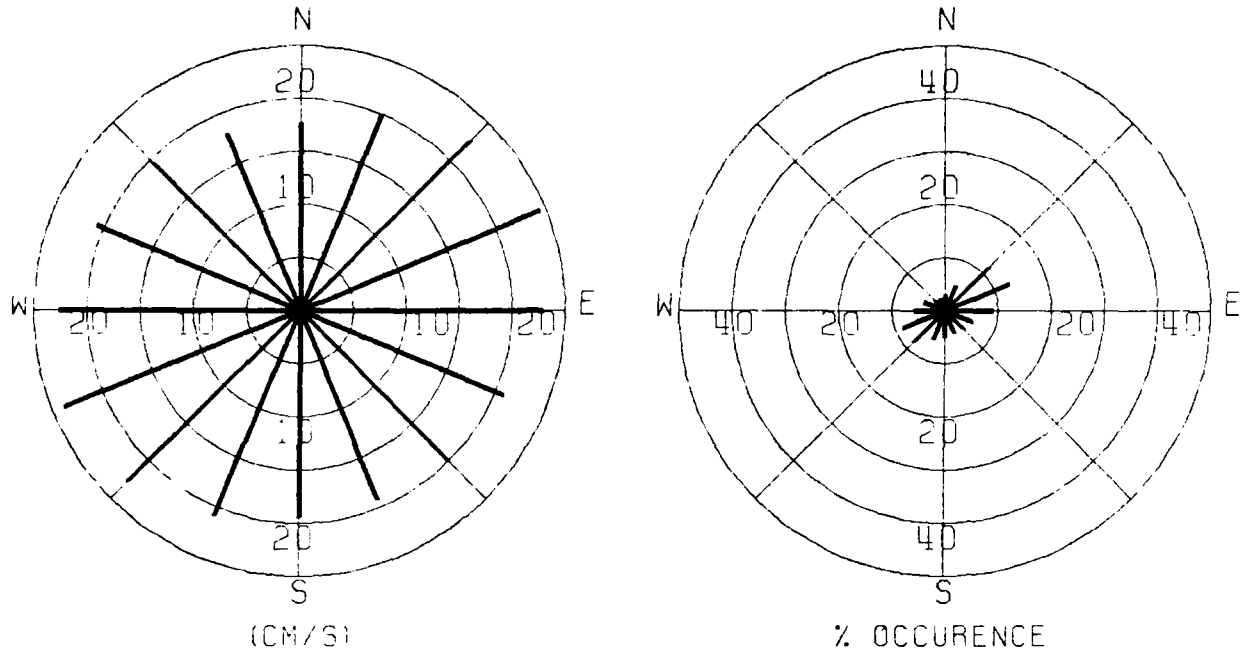
12. Wind data, during 1 May - 5 August, 1983, were obtained from records of Surface Weather Observations at Daughtery Field, Long Beach, located approximately five miles northeast of the harbor. Records were secured through the National Climatic Data Center. Observations were usually hourly, and, occasionally, more frequent. Data included wind speed in knots, wind direction, sky and ceiling observations, visibility in miles, sea level pressure in millibars, temperature in degrees Fahrenheit, and dew point in degrees Fahrenheit.

13. Wind data were plotted as rose plots and stick vectors and presented in Appendix D. Wind speed was converted to miles per hour (mph), and direction was shifted 180° to the direction toward which wind was blowing. One wind rose was plotted for the total period. Wind speed and direction stick vectors were plotted over seven day intervals.

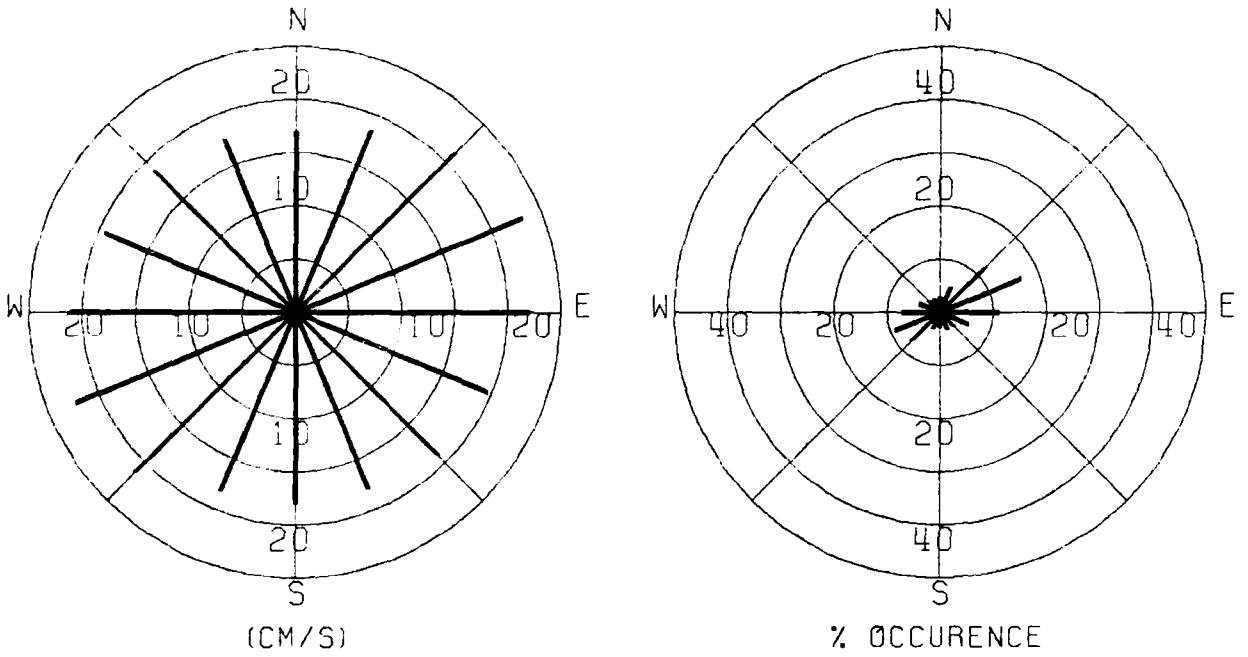
Results

14. Current data at each meter were divided into 16, 22.5 deg directional bands. Average speed and percent of flow occurring in each direction were plotted and presented in Figures 3-16.

15. Average speed for all directions, maximum velocity and direction, net velocity and direction, total depth of each meter, and the total depth at the station are listed in Table 1. Average speed was highest for surface meters at each station, except at Station 25, where the mid-depth meter was slightly higher. Maximum velocities also were strongest at the surface, although the bottom meter at Station 13 recorded a velocity equal to the surface.

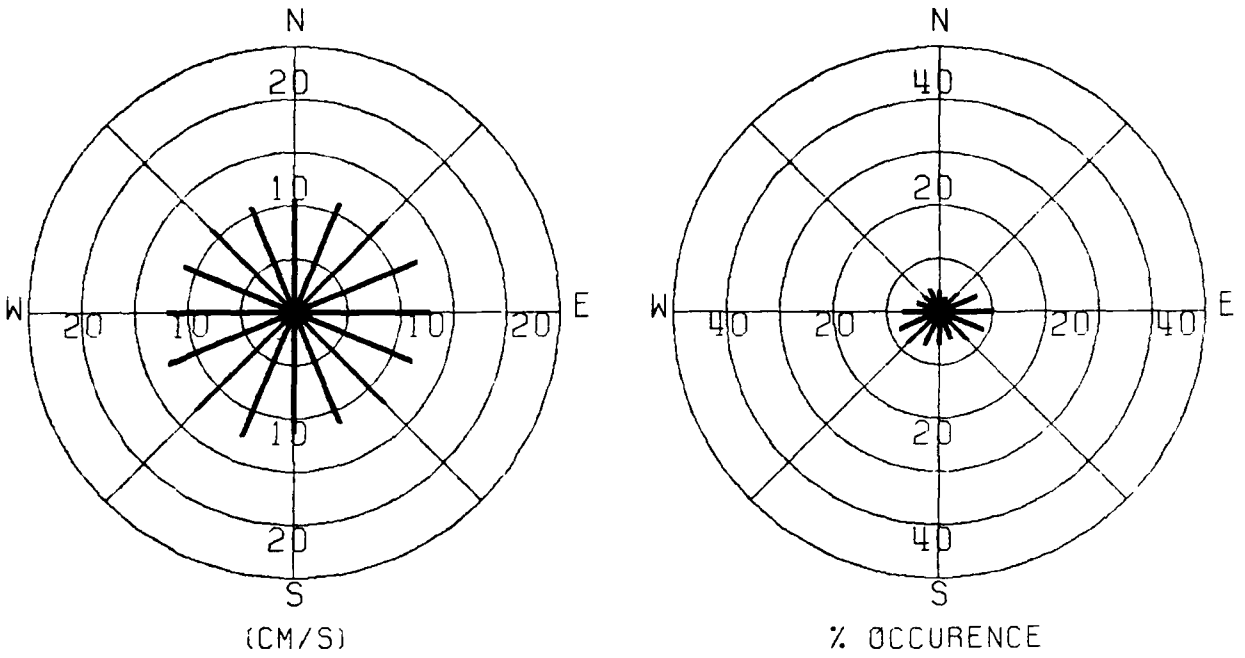


STATION 12, 7.3 M DEPTH

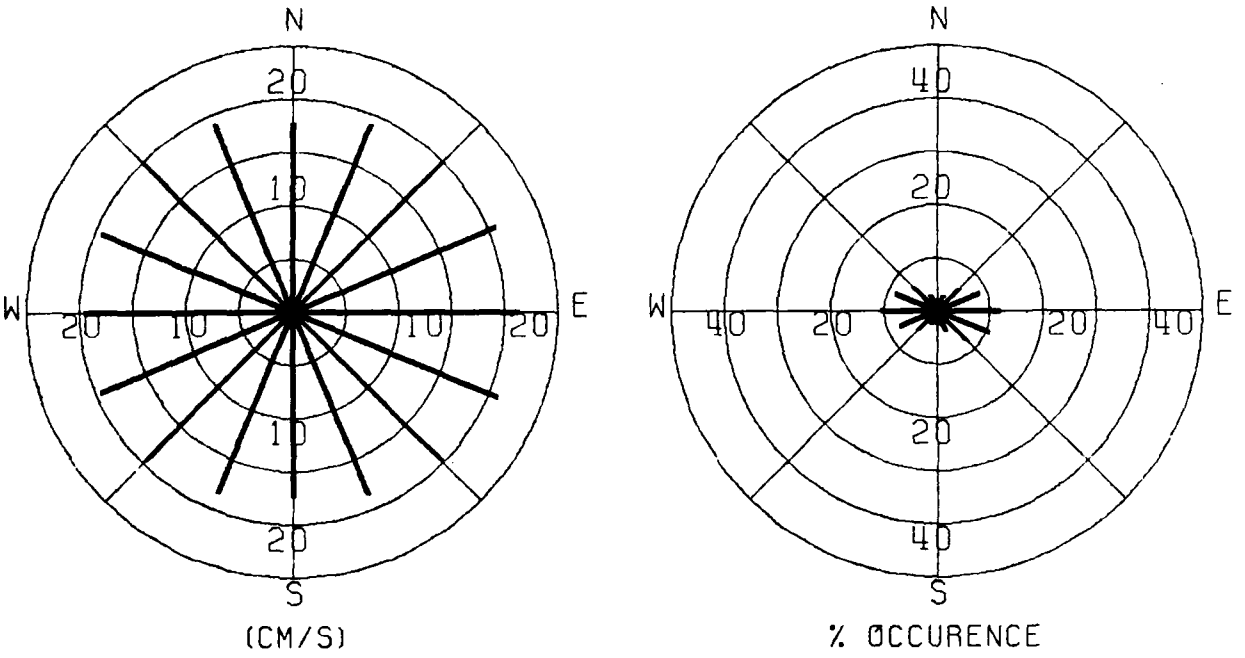


STATION 12, 10.4 M DEPTH

Figure 3. Average speed and percent occurrence by direction for surface and mid-depth meters at Station 12

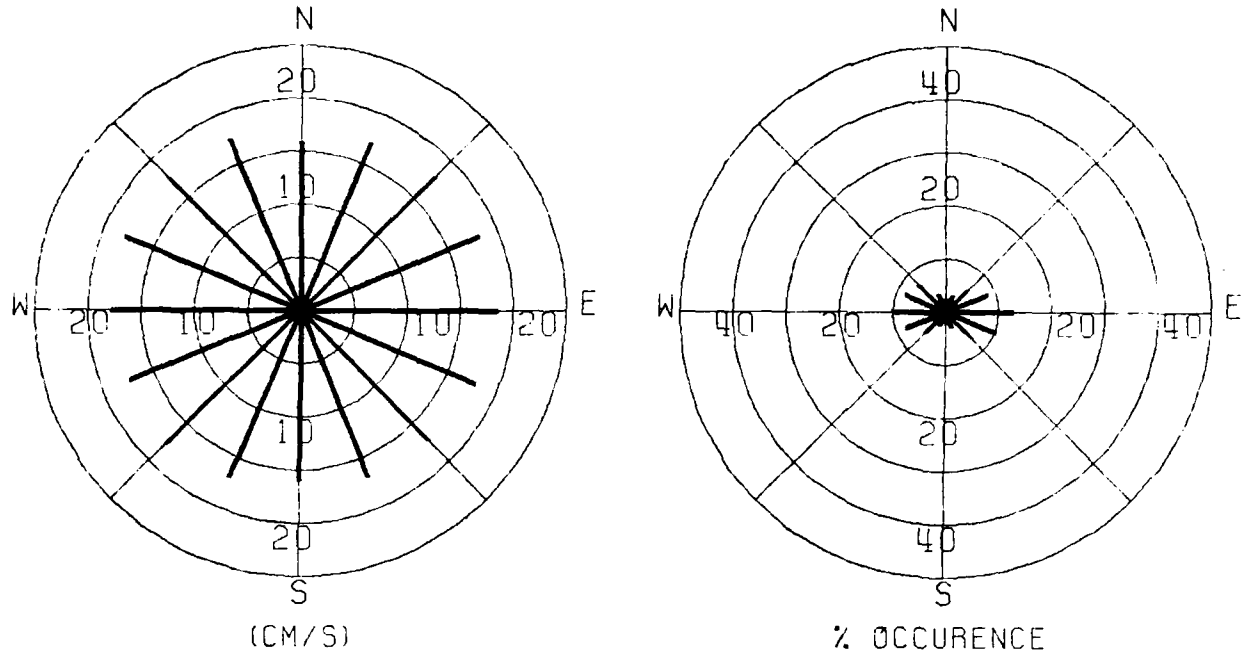


STATION 12, 18.0 M DEPTH

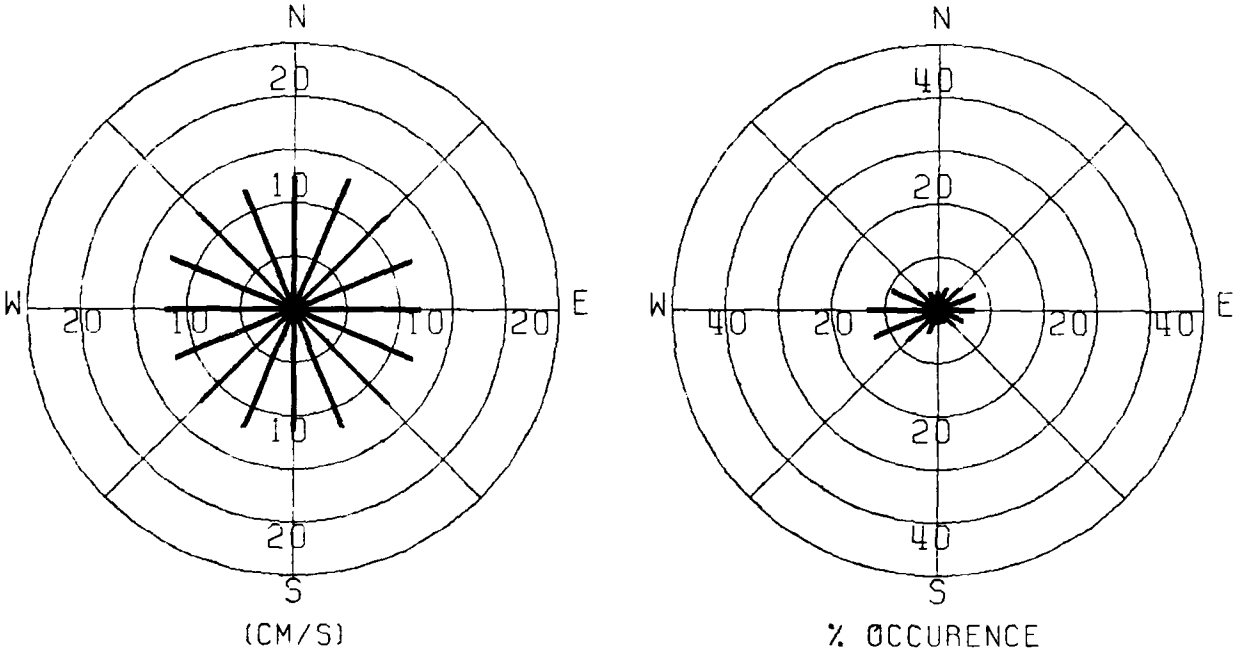


STATION 13, 5.5 M DEPTH

Figure 4. Average speed and percent occurrence by direction for bottom meter at Station 12 and surface meter at Station 13

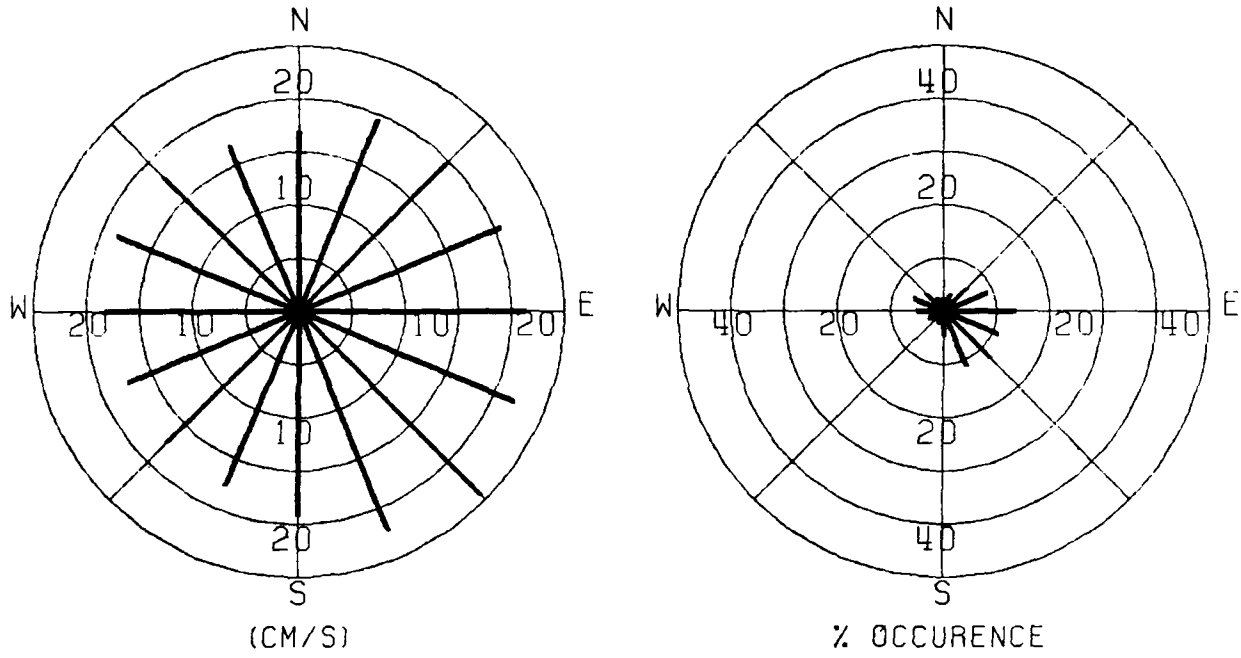


STATION 13, 8.5 M DEPTH

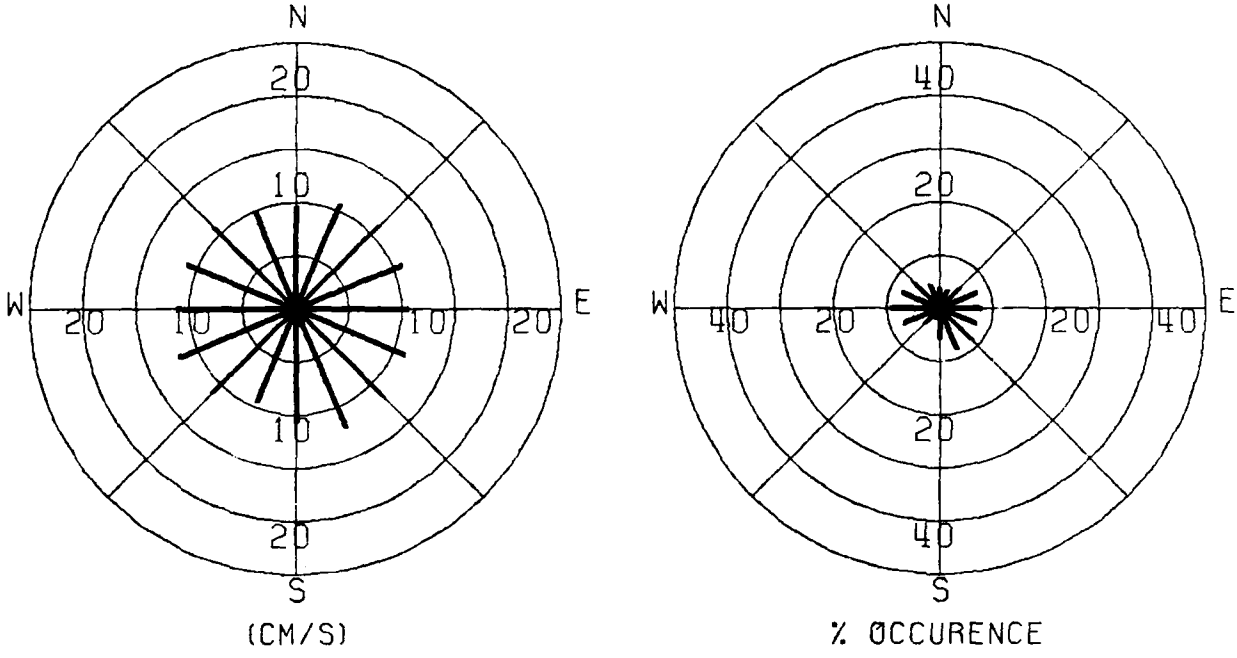


STATION 13, 17.7 M DEPTH

Figure 5. Average speed and percent occurrence by direction for mid-depth and bottom meters at Station 13

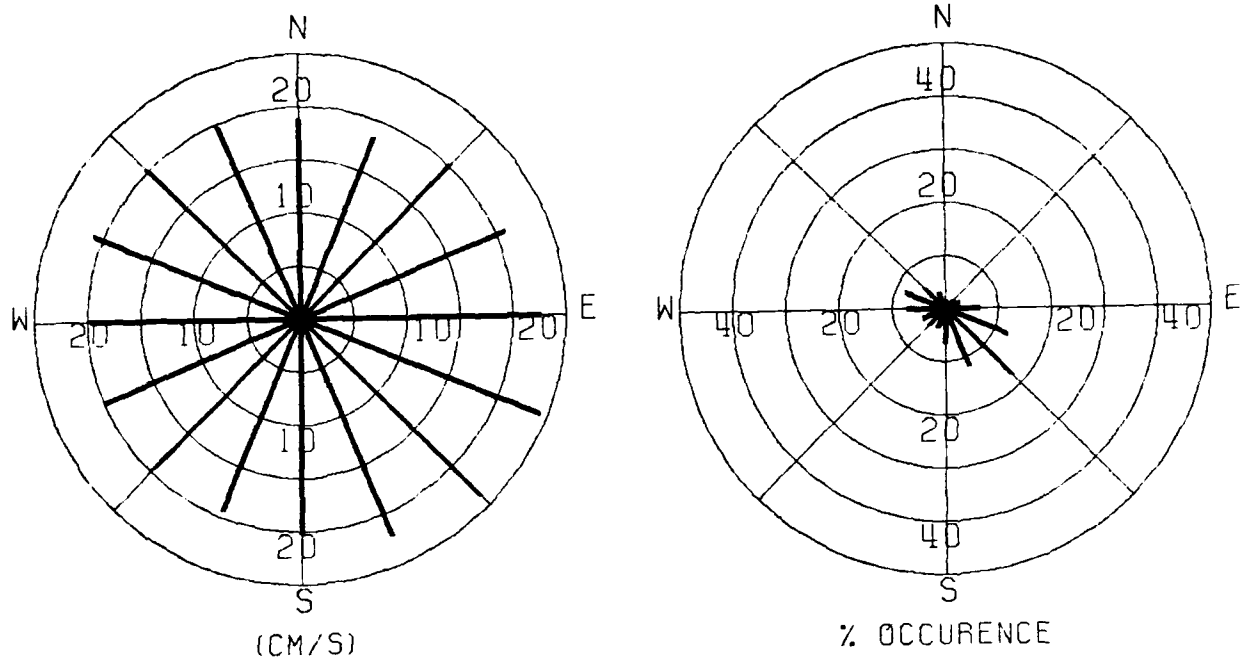


STATION 14, 4.6 M DEPTH

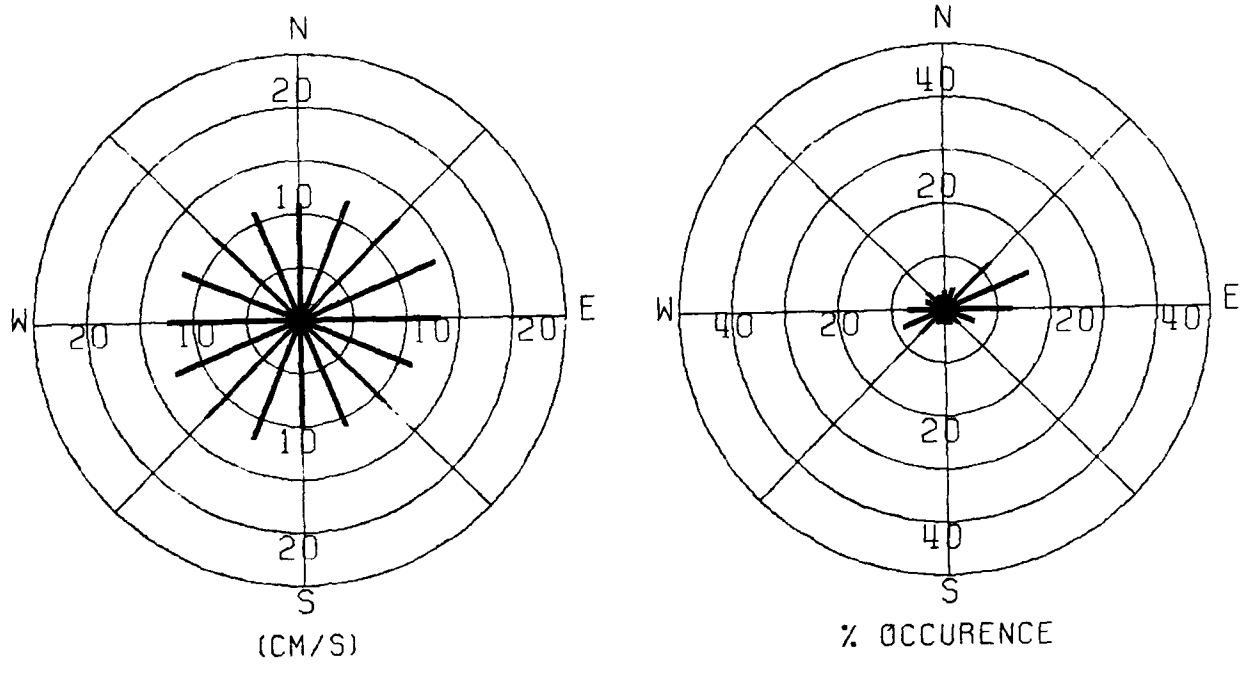


STATION 14, 12.8 M DEPTH

Figure 6. Average speed and percent occurrence by direction for surface and bottom meters at Station 14

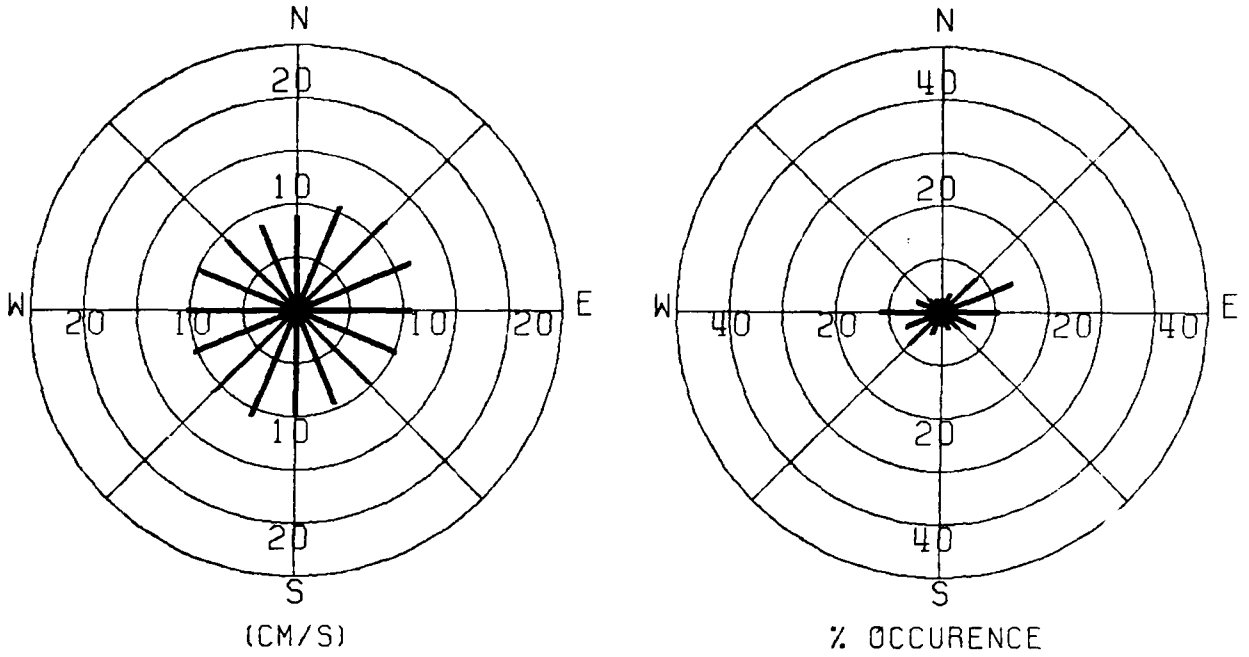


STATION 15, 4.3 M DEPTH

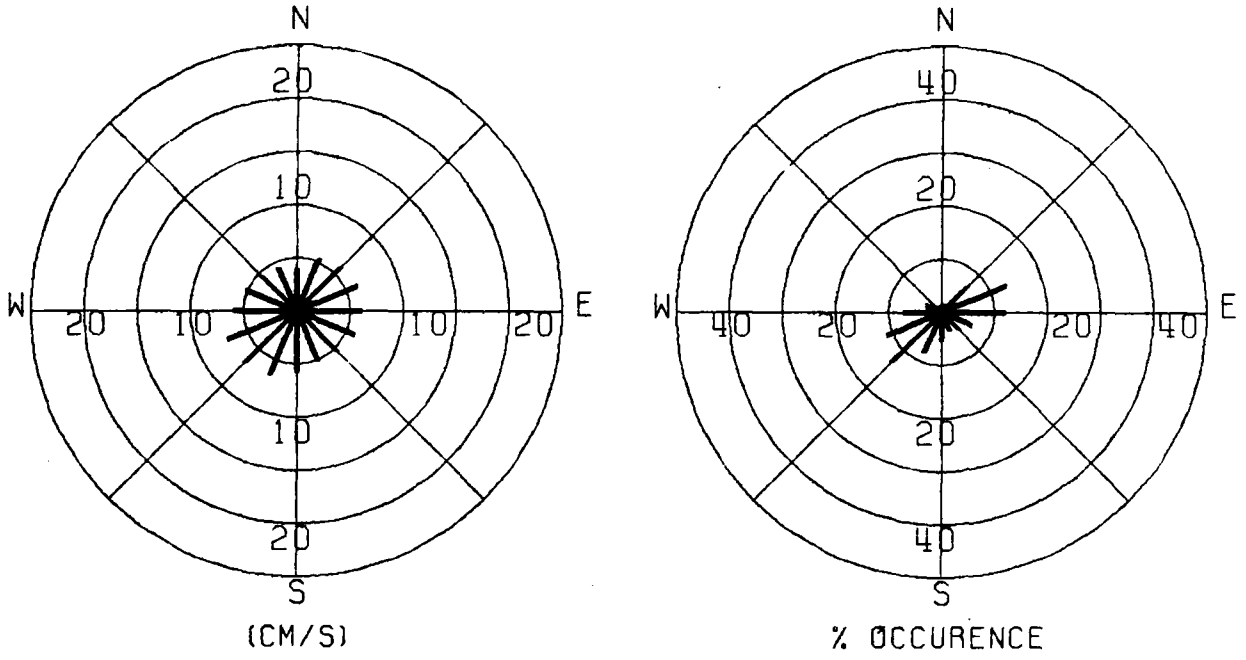


STATION 19, 4.3 M DEPTH

Figure 7. Average speed and percent occurrence by direction for surface meters at Stations 15 and 19

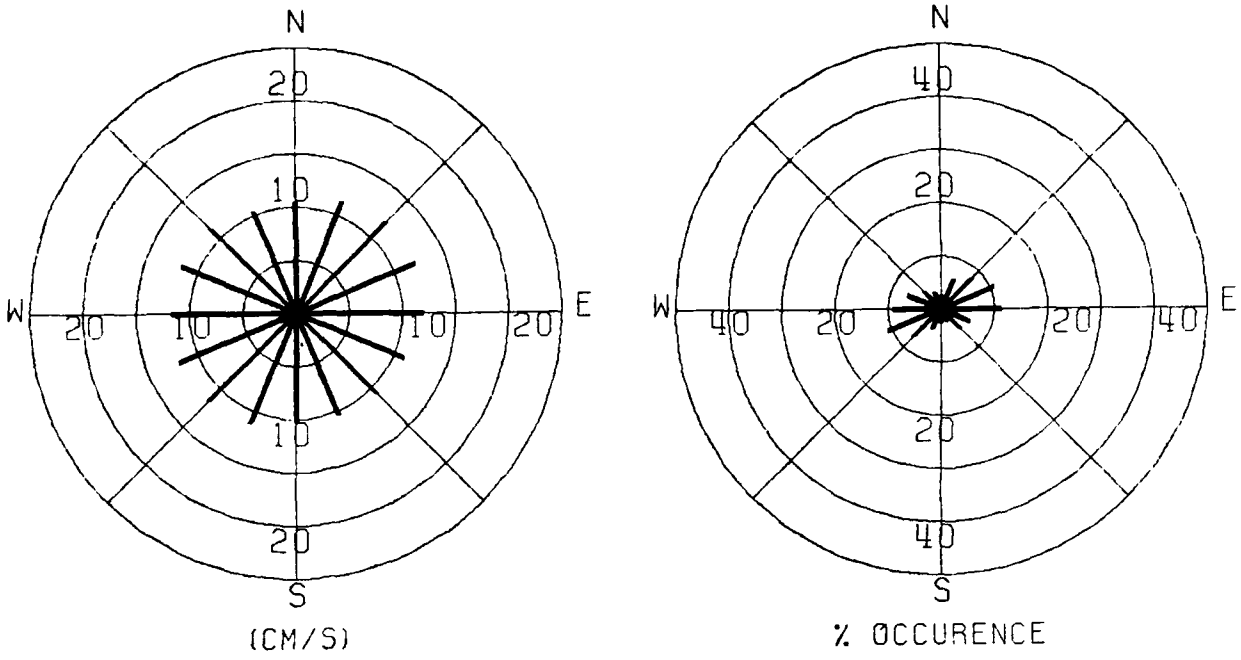


STATION 19, 7.3 M DEPTH



STATION 19, 13.4 M DEPTH

Figure 8. Average speed and percent occurrence by direction for mid-depth and bottom meters at Station 19



STATION 20, 6.4 M DEPTH

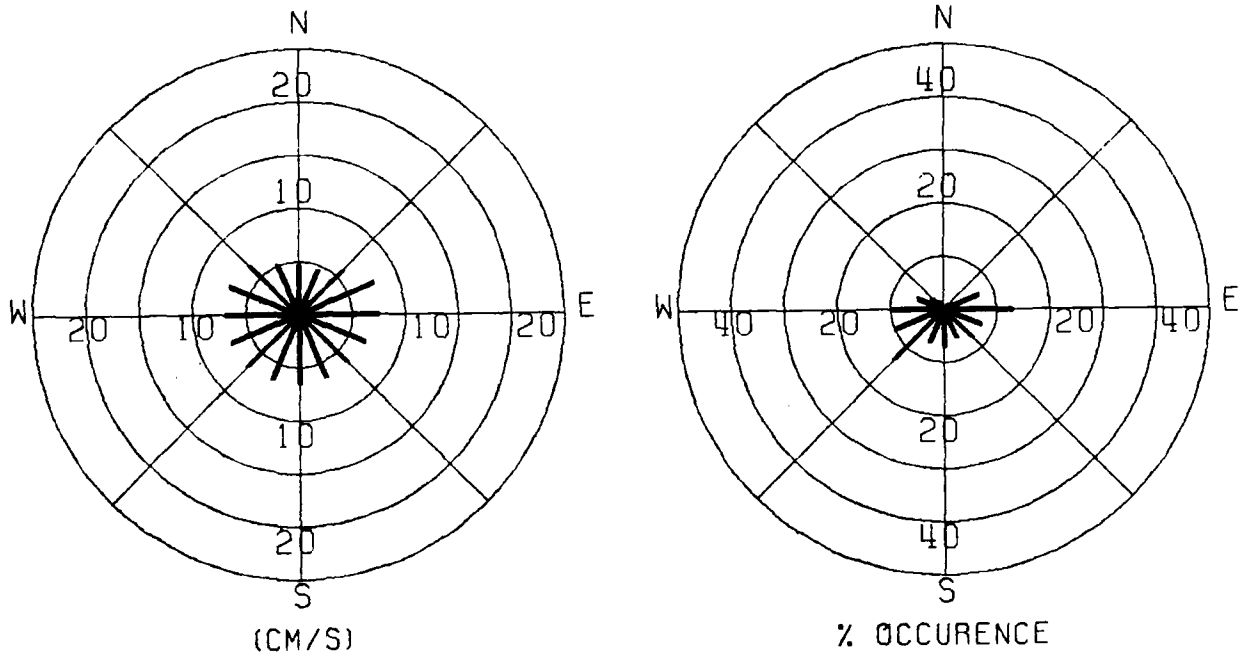
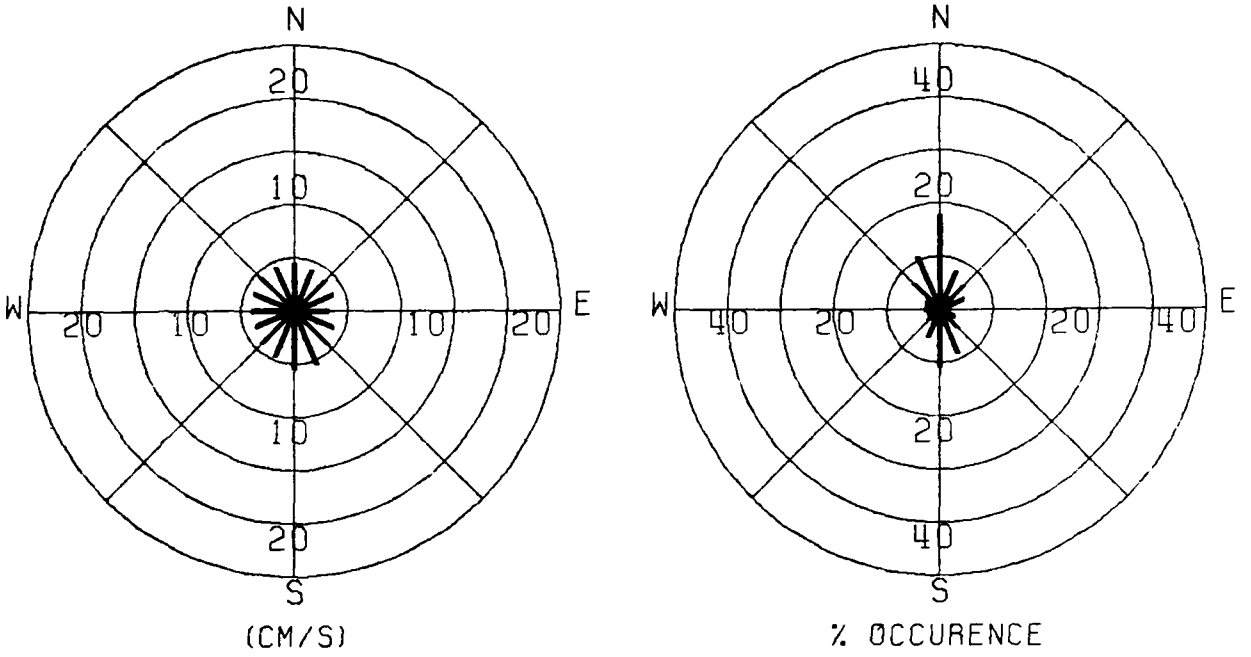
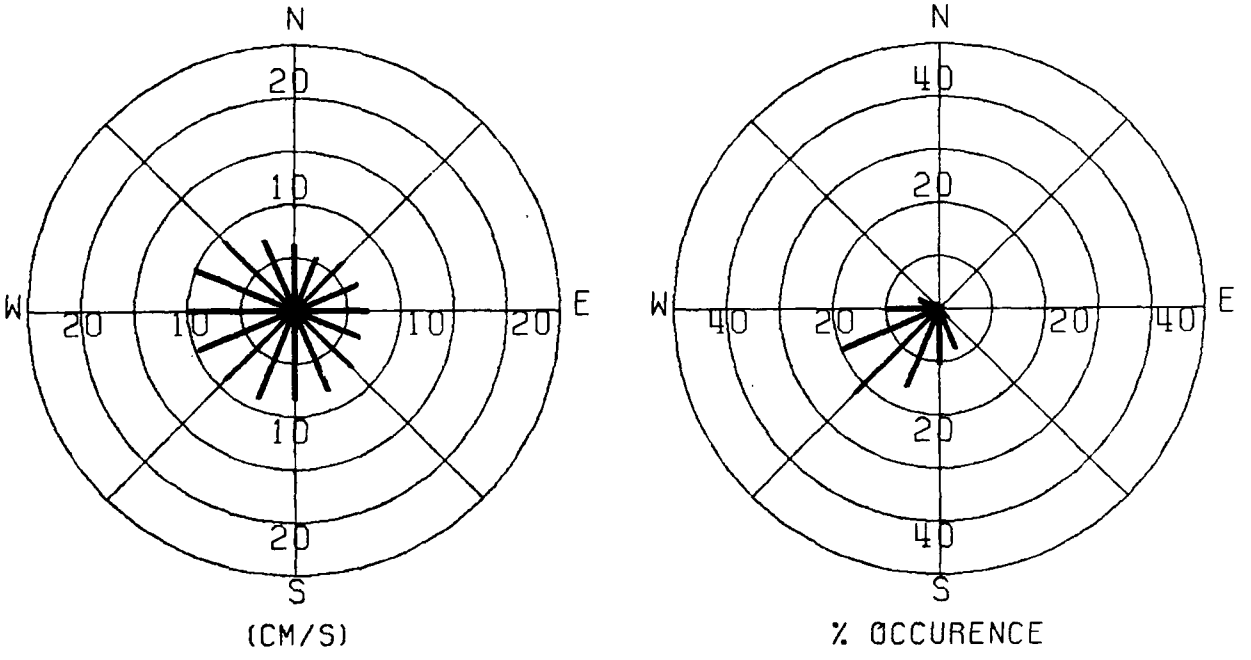


Figure 9. Average speed and percent occurrence by direction for surface and bottom meters at Station 20

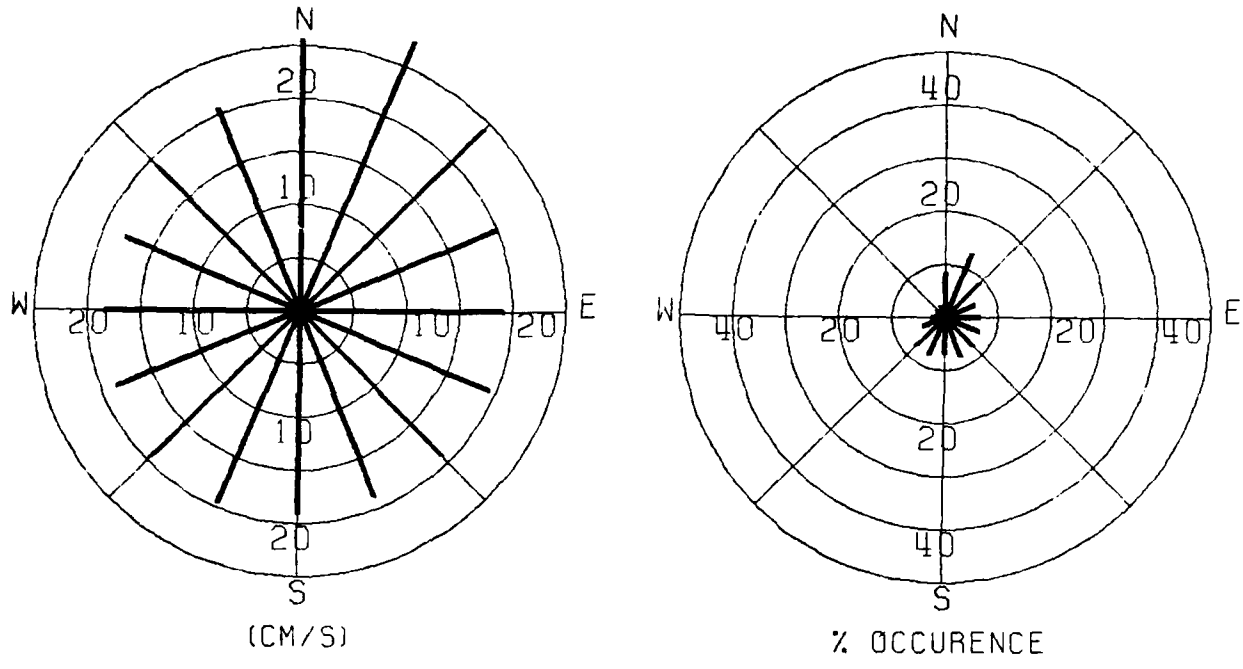


STATION 21, 12.5 M DEPTH

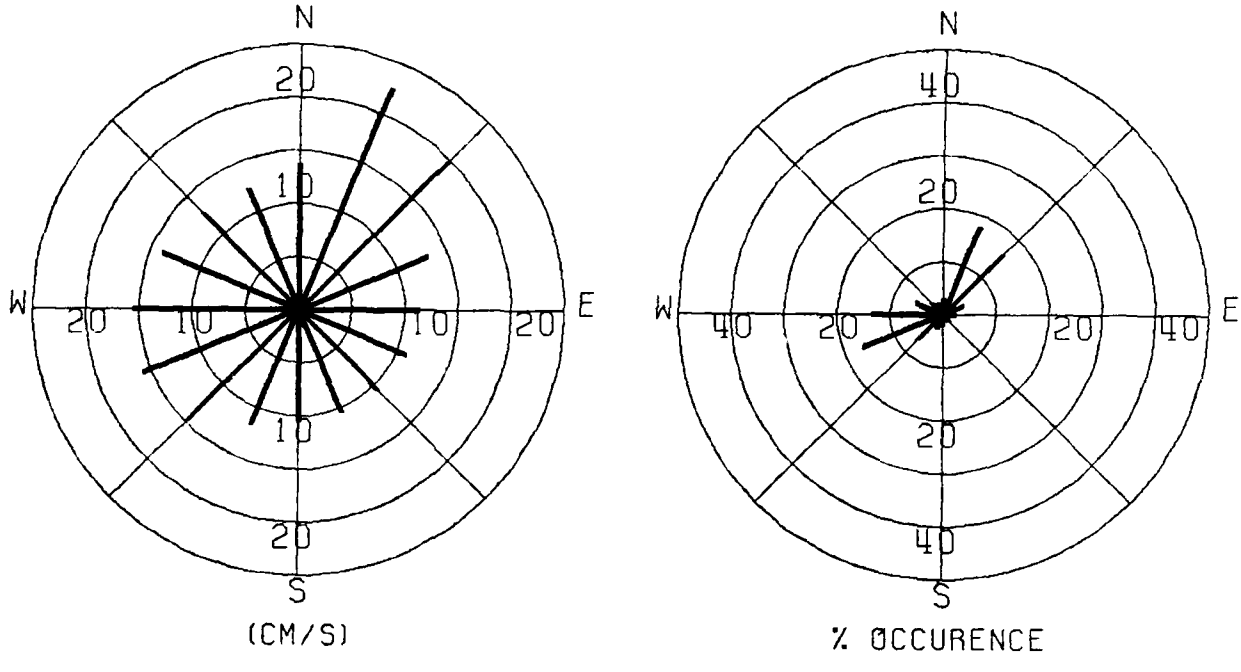


STATION 22, 6.1 M DEPTH

Figure 10. Average speed and percent occurrence by direction for bottom meters at Stations 21 and 22

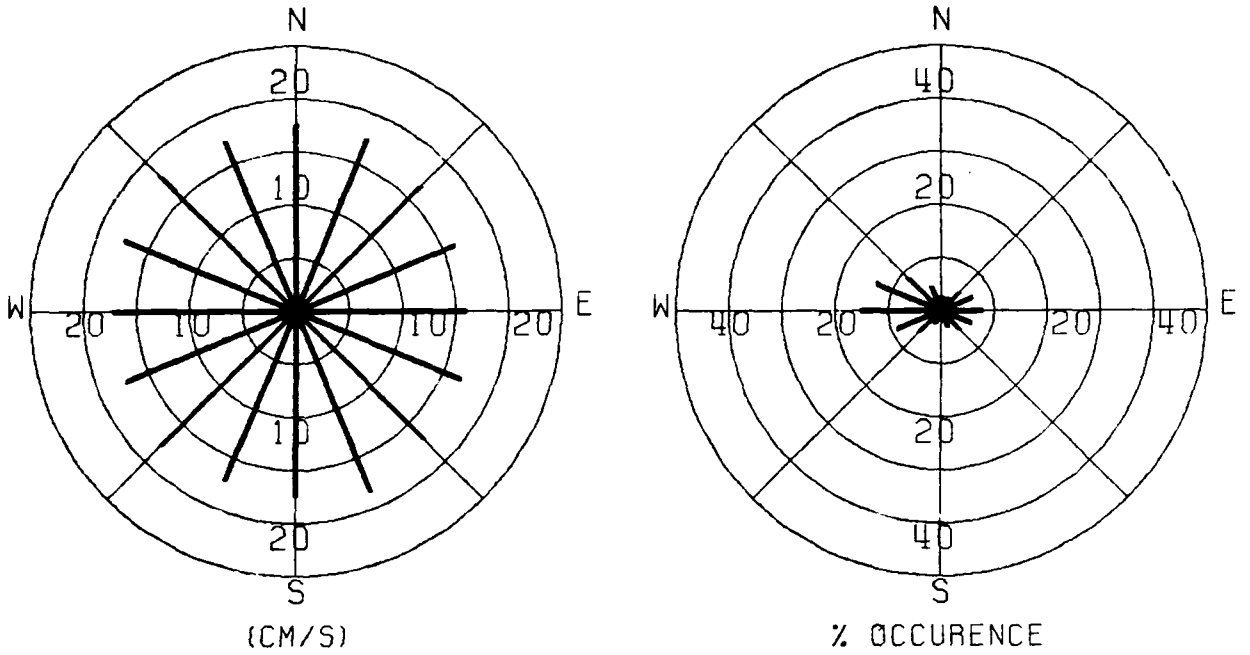


STATION 23, 3.4 M DEPTH

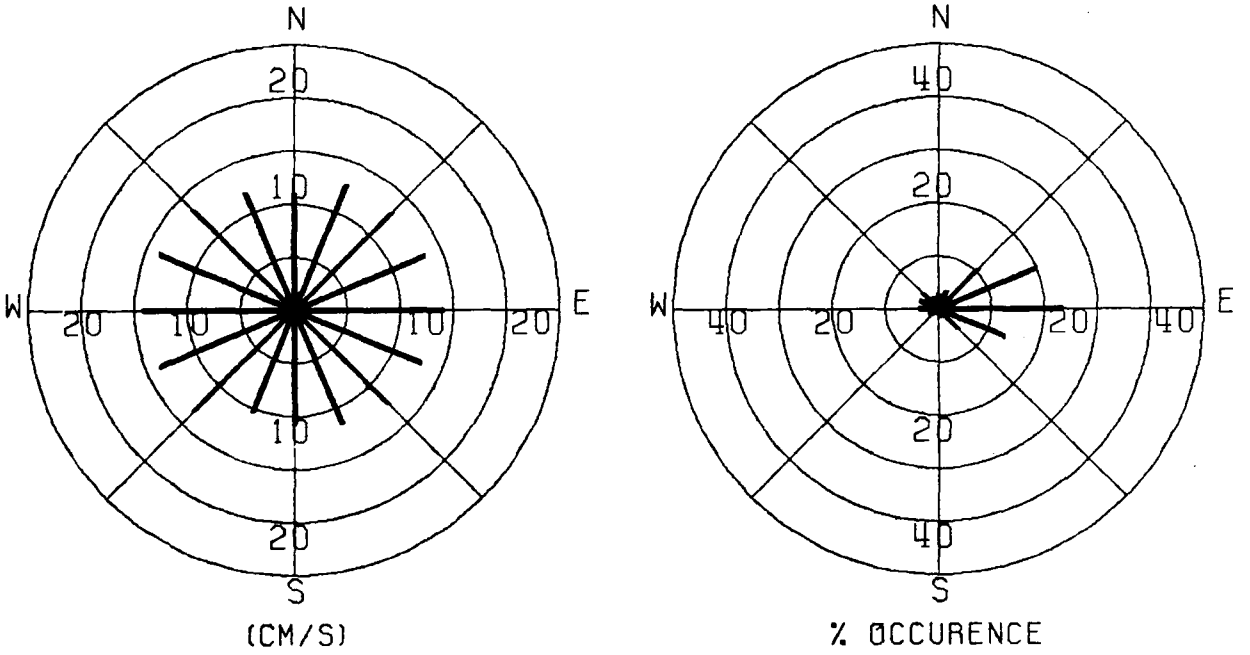


STATION 23, 13.1 M DEPTH

Figure 11. Average speed and percent occurrence by direction for surface and bottom meters at Station 23

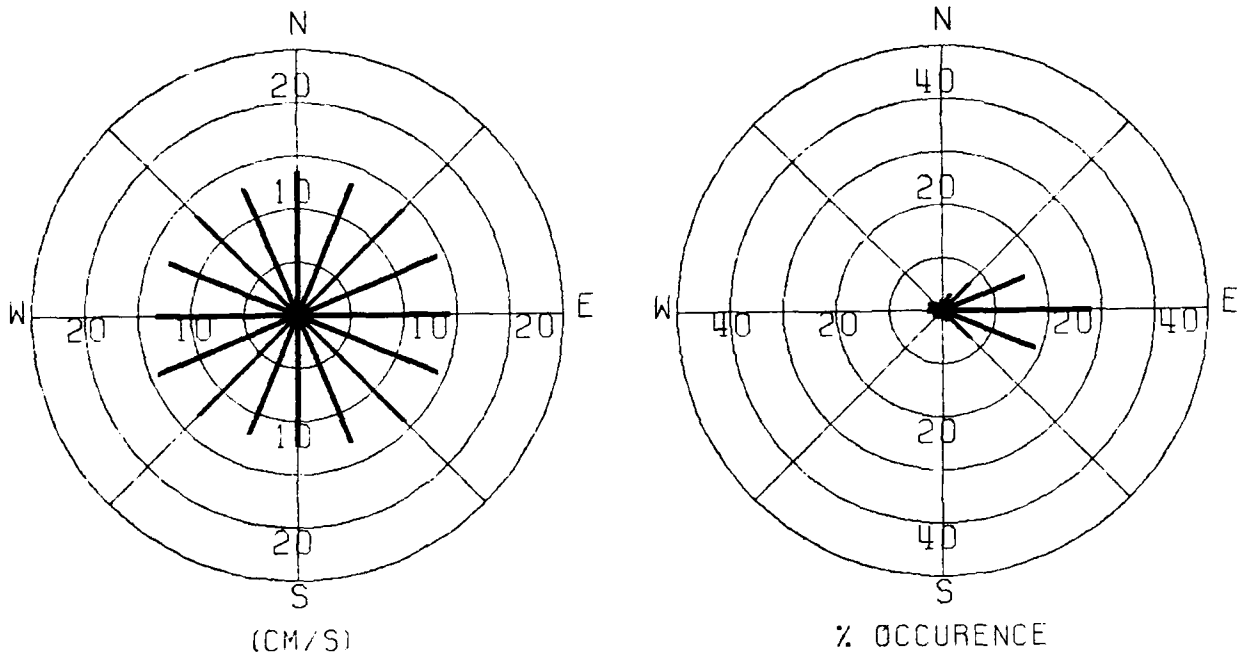


STATION 24, 4.9 M DEPTH

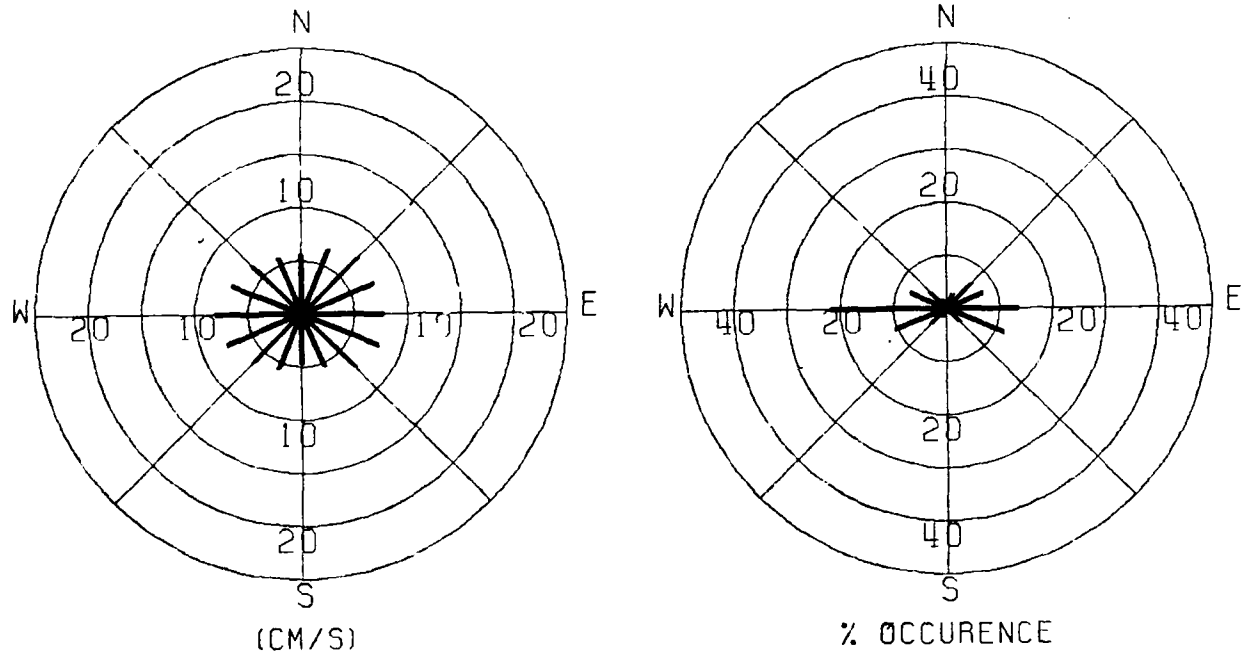


STATION 25, 4.6 M DEPTH

Figure 12. Average speed and percent occurrence by direction for surface meters at Stations 24 and 25

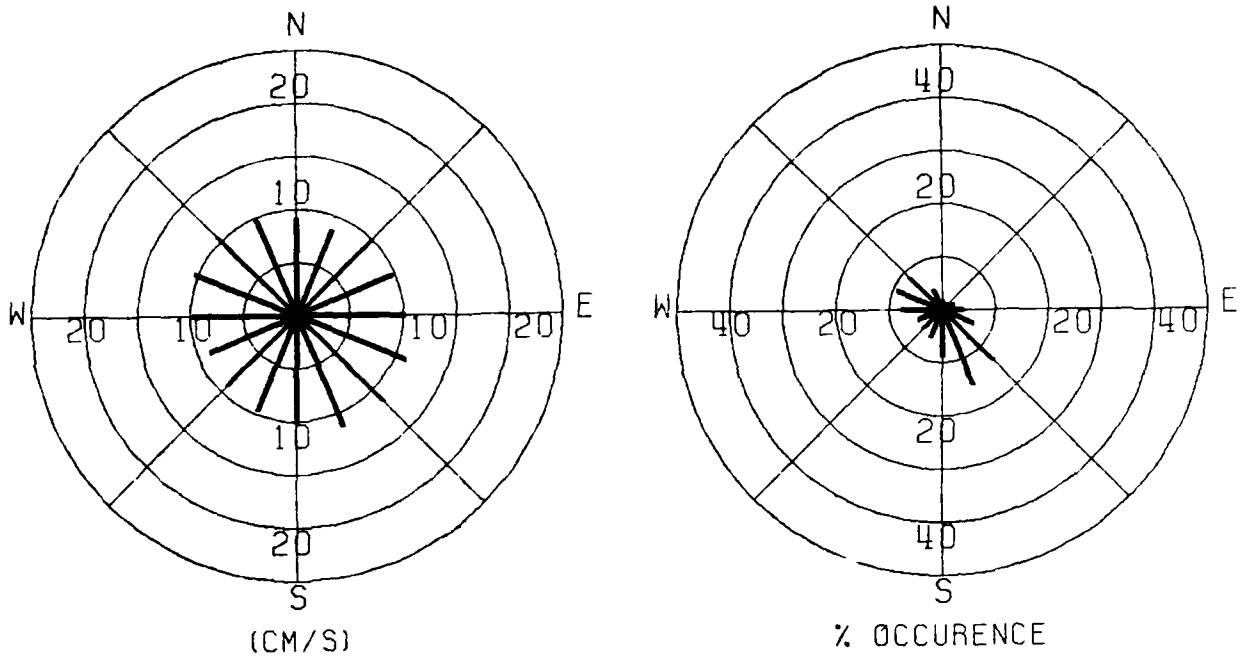


STATION 25, 7.6 M DEPTH

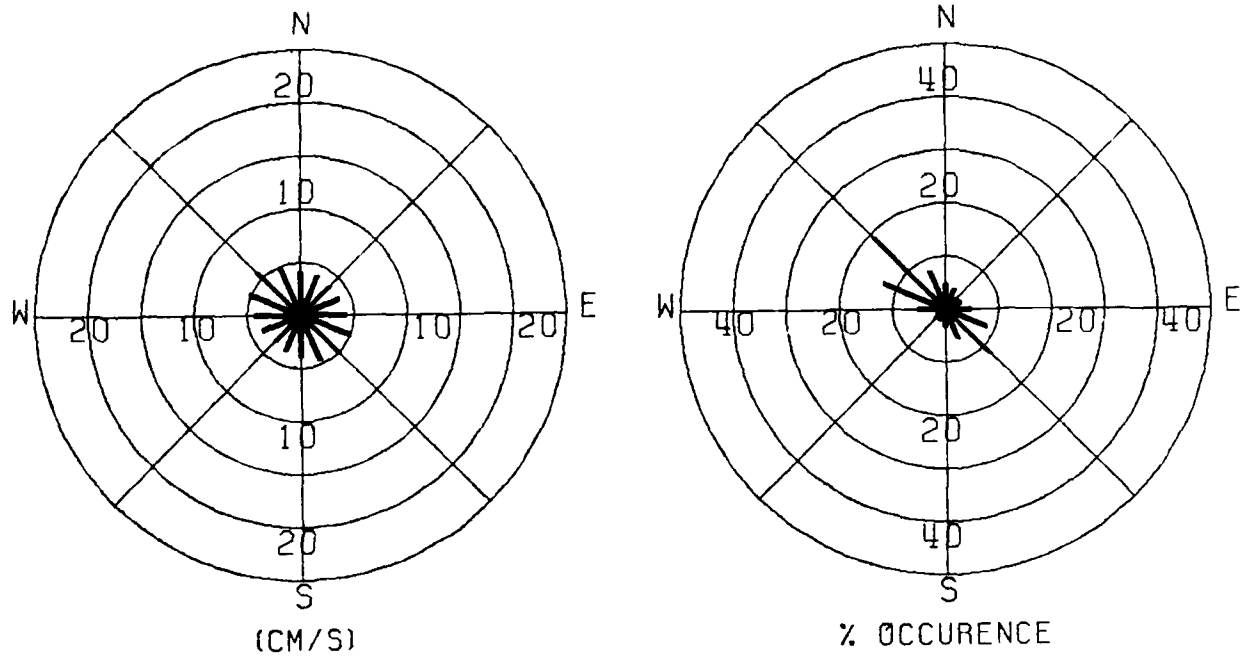


STATION 25, 19.2 M DEPTH

Figure 13. Average speed and percent occurrence by direction for mid-depth and bottom meters at Station 25

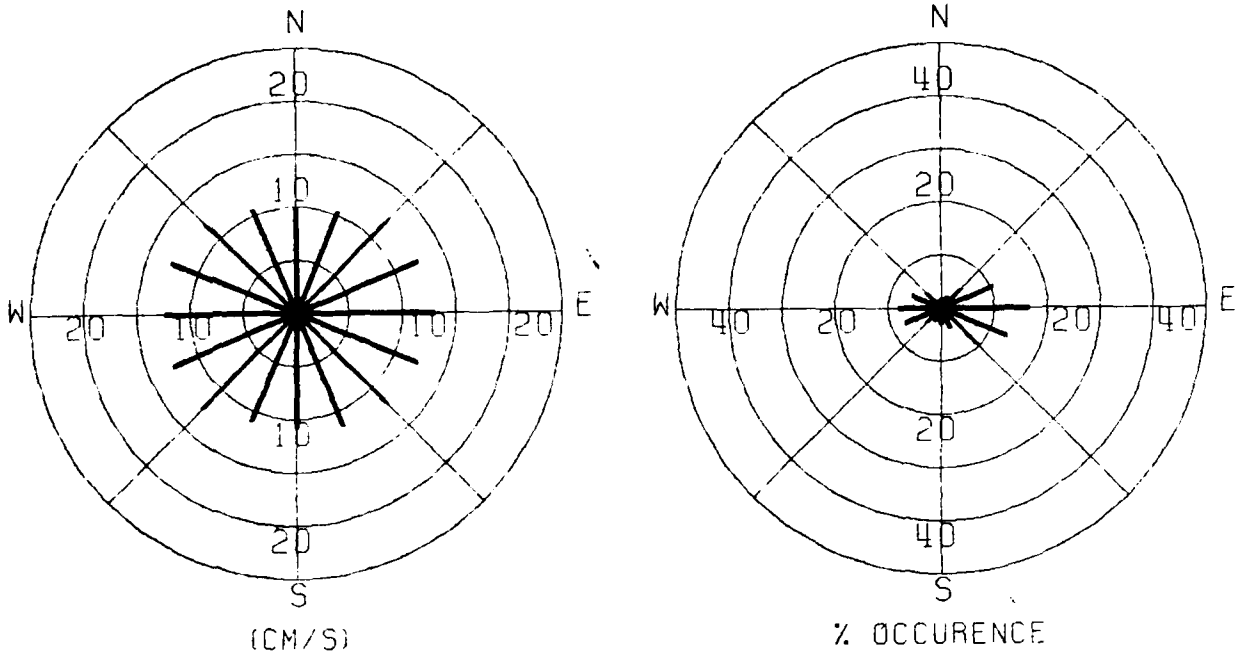


STATION 26, 4.6 M DEPTH

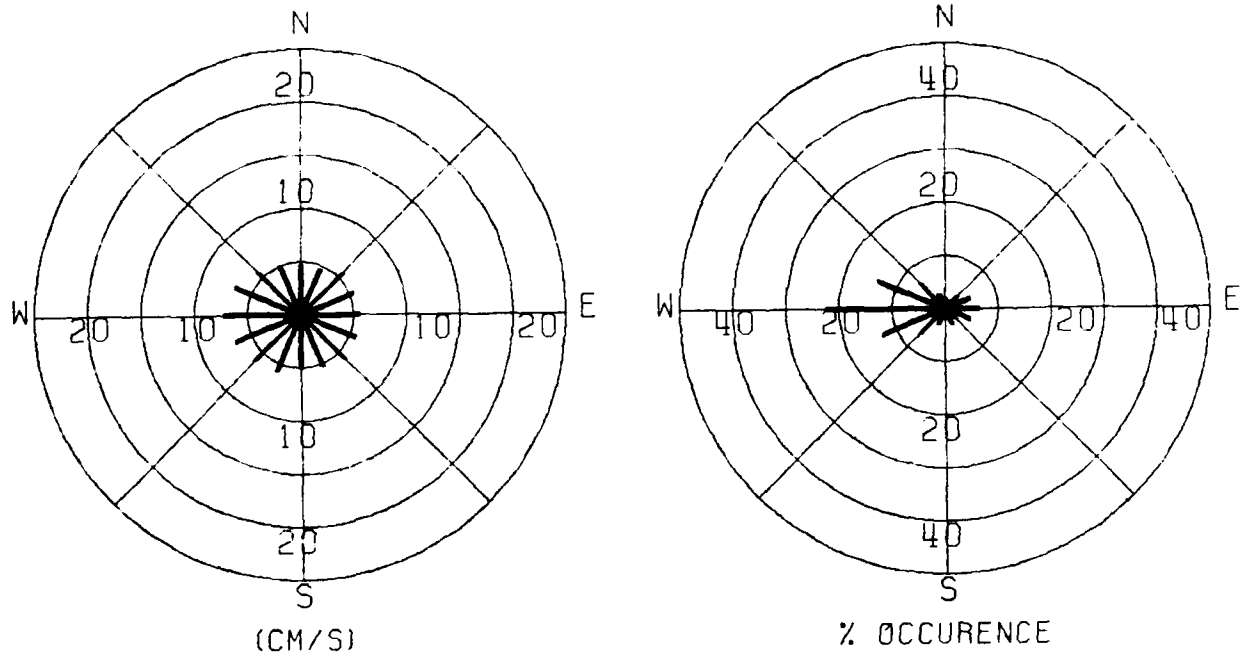


STATION 26, 17.7 M DEPTH

Figure 14. Average speed and percent occurrence by direction for surface and bottom meters at Station 26

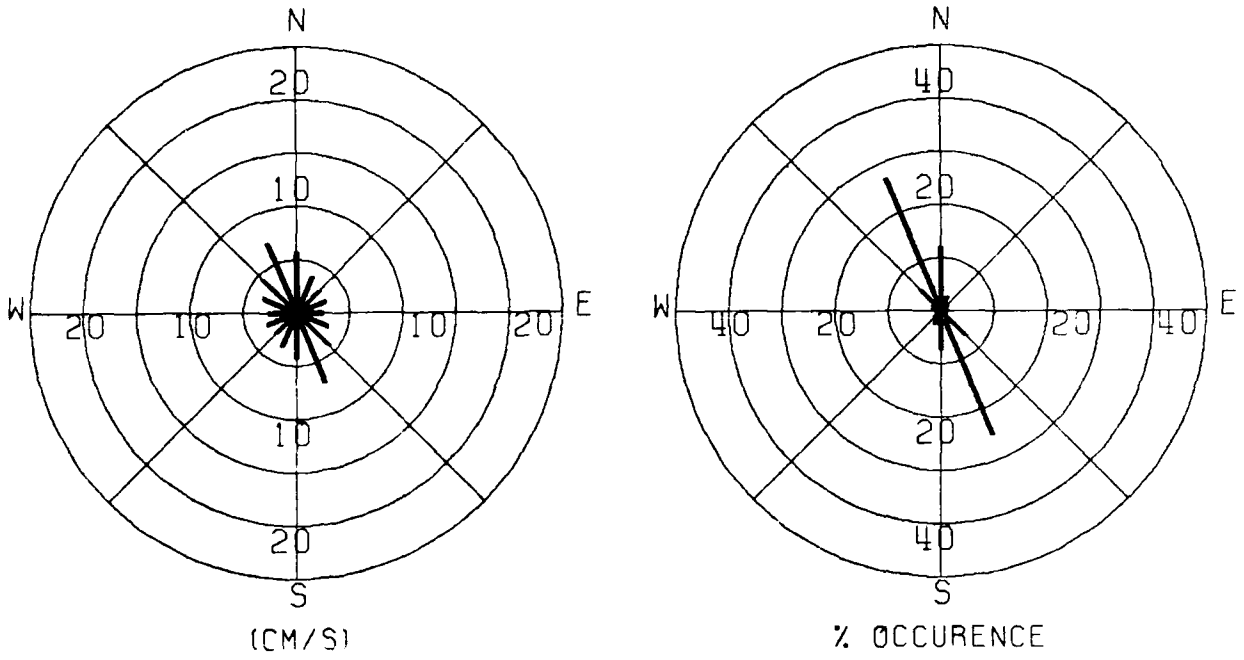


STATION 30, 4.0 M DEPTH

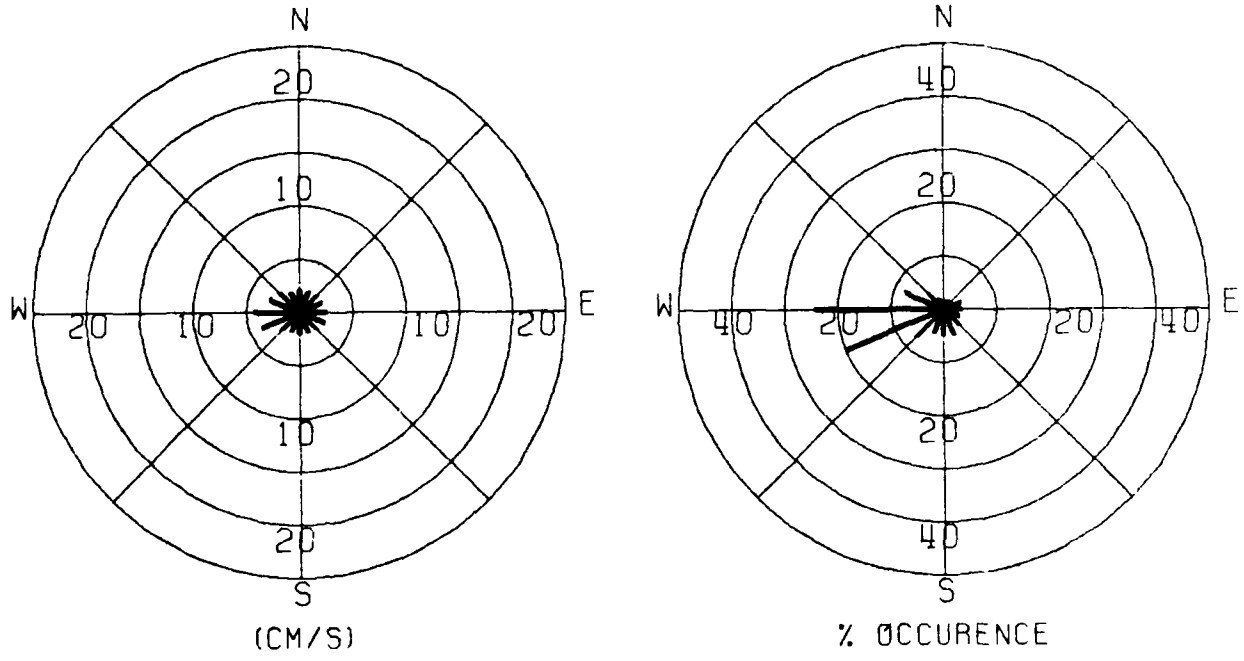


STATION 30, 13.1 M DEPTH

Figure 15. Average speed and percent occurrence by direction for surface bottom meters at Station 30



STATION 33, 4.3 M DEPTH



STATION 35, 4.9 M DEPTH

Figure 16. Average speed and percent occurrence by direction for surface meters at Stations 33 and 35

16. Average wind speeds and percent of occurrence in each 22.5° band are tabulated in Table 2. Wind most frequently blew to the north, north-northeast, east and south-southeast during the data collection period. Highest average wind speeds occurred for the east and east-northeast directions. The wind rose plot in Appendix D shows maximum wind speeds were east to northeast.

Outside Harbor

17. Average speeds at stations outside the harbor, Stations 12-15, vary little by direction. However, percent occurrence plots show dominant flow primarily in two directions. The highest percent of flow at the surface and mid-depth meters of Station 12 was east-northeast, and east at the bottom. Flow was mainly east at the surface and mid-depth meters of Station 13, and west to west-southwest near the bottom. Surface currents at Station 14 were predominantly east to south-southeast, and west on the bottom. Flow at Station 15 was mostly SE at surface. Except for Station 23, near Angel's Gate, maximum current speeds over the survey period occurred outside the breakwater.

18. Surface and mid-depth currents were affected more than bottom currents by winds. During several periods, offshore currents did not oscillate and tended to flow in approximately the same direction as occurred at Station 12, 16 July - 21 July (pp B9 and B10). Similar events occurred at the other offshore stations but usually at different time periods. Correlation with changes in wind direction is not consistent, perhaps due to the location of the wind gage at the airport. Occasionally, wind appeared to influence bottom currents, but bottom currents were primarily oscillatory.

Outer Harbor

19. Current directions in the outer harbor oscillated between two to three directions. Dominant flow was mainly east for surface and mid-depth meters, except for Stations 23, 24, and 26. Bottom flow was mostly westerly, except at Station 21, where dominant flows were oriented north, south, and north-northeast, approximately in the direction of the main channel. Average speed was slightly higher at Station 21 to the south, but was relatively consistent in all other directions. Average current speed at Station 23,

located near the Angel's Gate entrance, was strong in the flood direction, NNE, which was also the predominant flow. The two highest current magnitudes (58.0 and 53.0 cm/s) for the collection period were recorded at the surface and bottom meters of Station 23 (in the flood direction) and occurred within eight minutes. Average flow was uniform in all directions at Station 24 (16 to 18 cm/s). Station 24 appears to be sheltered from flow in the ebb direction by Pier J and the predominant flow was west to west-northwest. Flow at Station 25 was evenly distributed at surface (10-14 cm/s), mid-depth (12-14 cm/s), and bottom (11-13 cm/s). Highest percent of flow was east at surface and mid-depth meters, and west at the bottom. Currents at Station 26 followed the Long Beach Channel alignment, NW and SE, for surface and bottom meters. Average velocity was consistent (10-14 cm/s) in all directions.

20. Effect of wind on the outer harbor stations was similar to the effect on stations outside the breakwater. Surface and mid-depth currents experienced long periods of almost unidirectional flow, such as 13 June - 15 June at Station 20 (p B34). Bottom currents continued to oscillate during these periods.

Back Channel

21. Currents at Station 33, in the Long Beach Harbor inner channel, follow the channel alignment, WNW and ESE, but were most frequently WNW. Maximum average flow also was WNW and ESE. At Station 35, flow was predominately west and west-southwest, approximately in the direction of the channel near the boundary between the Ports. Net direction (Table 1) calculated for Stations 33 and 35 indicate flow was counterclockwise in the back channel.

PART III: SUMMARY

22. Current, tide, and wind data from 1983 are presented for Los Angeles and Long Beach Harbors. Figures presented can be used for comparison with model results from the area.

23. Analysis of prototype data during the observation period indicates:

a. Average current speed by direction at most stations was relatively uniform. However, frequency of occurrence data indicated flow was generally in two main directions.

b. Highest wind speeds were blowing to the east and northeast.

c. Surface currents outside the breakwater were easterly, ENE to SSE.

d. Surface currents in the outer harbor area were easterly at most stations. Bottom currents were westerly at most stations.

e. Bottom currents appear to be oscillatory during periods when surface currents can be approximately unidirectional, apparently under the influence of local winds.

f. Wind affects were not as apparent in the back channel area as in the outer harbor and outside the breakwater.

g. Flow in the back channel was predominantly counterclockwise.

Table 1

Maximum, Average, and Net Currents

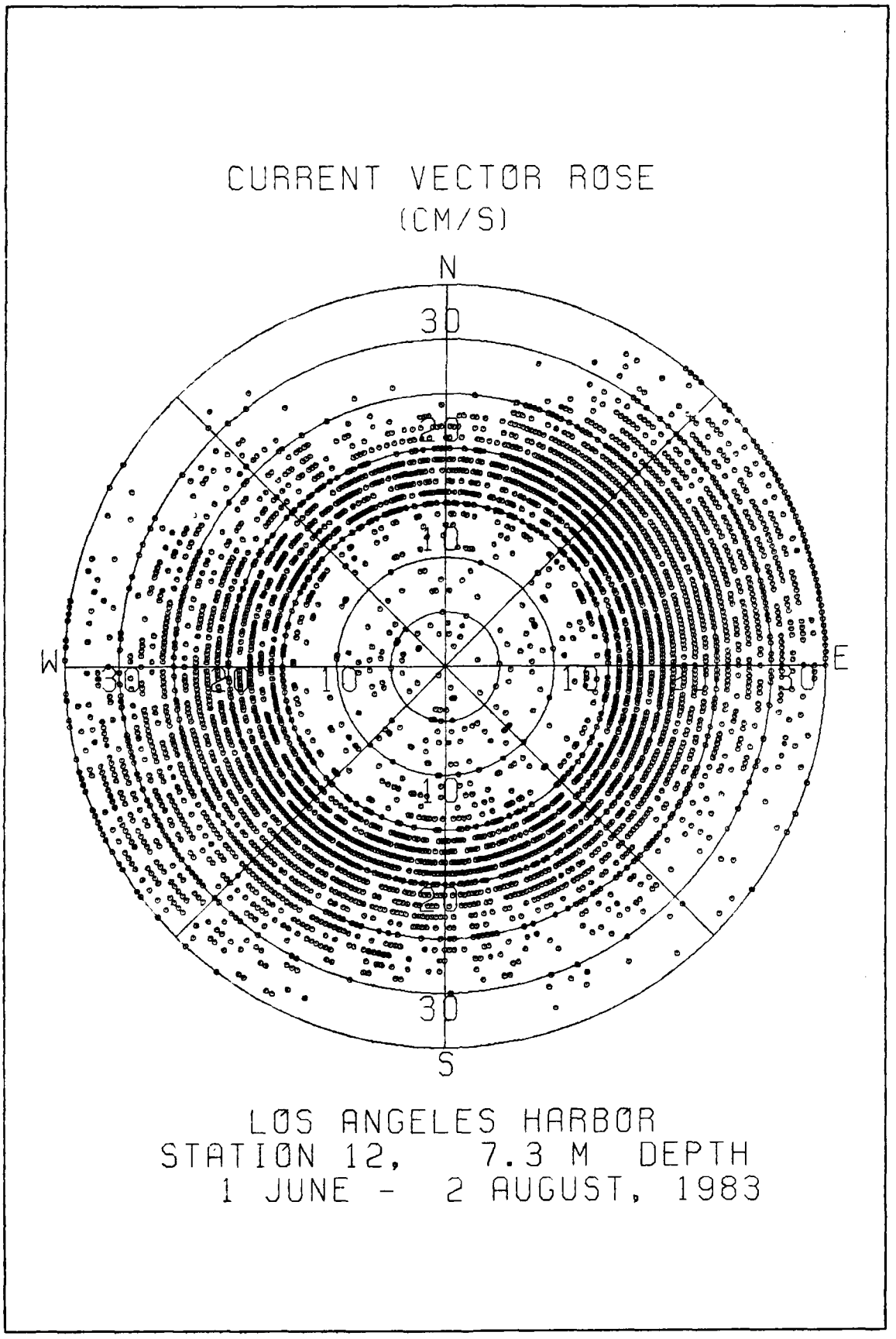
Station	Speed		Direction	Net		Depth (MLW)	
	Ave cm/s	Max cm/s	@Max degrees	Speed cm/s	Direction degrees	Sensor m	Station m
12S	21.8	52.0	73.0	3.1	99.6	7.3	19.5
12M	20.7	45.0	64.0	4.1	287.7	10.4	19.5
12B	12.0	33.0	144.0	2.0	158.2	18.0	19.5
13S	19.9	41.0	39.0	1.8	103.5	5.5	19.2
13M	17.7	38.0	159.0	1.1	287.5	8.5	19.2
13B	12.2	41.0	312.0	2.3	82.4	17.7	19.2
14S	20.6	45.0	153.0	8.2	113.5	4.6	14.3
14B	11.0	28.0	66.0	0.7	156.0	12.8	14.3
15S	21.6	39.0	123.0	7.3	151.5	4.3	12.2
19S	12.4	29.0	61.0	3.0	293.9	4.3	14.9
19M	10.5	19.0	90.0	1.1	275.4	7.3	14.9
19B	6.1	14.0	246.0	1.3	173.3	13.4	14.9
20S	11.5	21.0	253.0	0.5	321.6	6.4	14.0
20B	6.8	13.0	81.0	2.0	182.4	12.5	14.0
21B	4.5	11.0	164.0	0.4	342.1	12.5	14.0
22B	9.0	16.0	255.0	6.7	224.9	6.1	7.6
23S	21.3	58.0	32.0	4.9	285.4	3.4	14.6
23B	16.5	53.0	25.0	5.0	17.0	13.1	14.6
24S	17.2	35.0	159.0	3.9	76.7	4.9	12.5
25S	13.3	30.0	28.0	7.4	283.9	4.6	20.7
25M	14.0	27.0	48.0	9.0	271.5	7.6	20.7
25B	7.4	18.0	269.0	0.4	78.5	19.2	20.7
26S	10.4	25.0	137.0	3.0	182.9	4.6	19.2
26B	4.8	13.0	319.0	0.9	38.4	17.7	19.2
30S	12.2	25.0	283.0	3.2	108.1	4.0	14.6
30B	6.2	14.0	272.0	2.8	267.2	13.1	14.6
33S	5.7	26.0	344.0	0.5	1.2	4.3	12.8
35S	3.1	14.0	214.0	1.9	256.5	4.9	14.6

Table 2

Average Wind Speed by Direction

Direction	Average Speed mph	Percent Occurrence
NNE	8.5	12.8
NE	8.1	2.2
ENE	9.5	2.0
E	9.8	12.6
ESE	8.1	10.4
SE	5.3	3.1
SSE	4.1	0.7
S	4.1	1.3
SSW	4.0	1.6
SW	4.2	1.3
WSW	4.5	1.4
W	4.7	2.5
WNW	5.6	3.3
NW	6.2	5.0
NNW	7.8	7.3
N	8.7	18.0
No Wind		14.5

APPENDIX A: CURRENT ROSE PLOTS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(CM/S)
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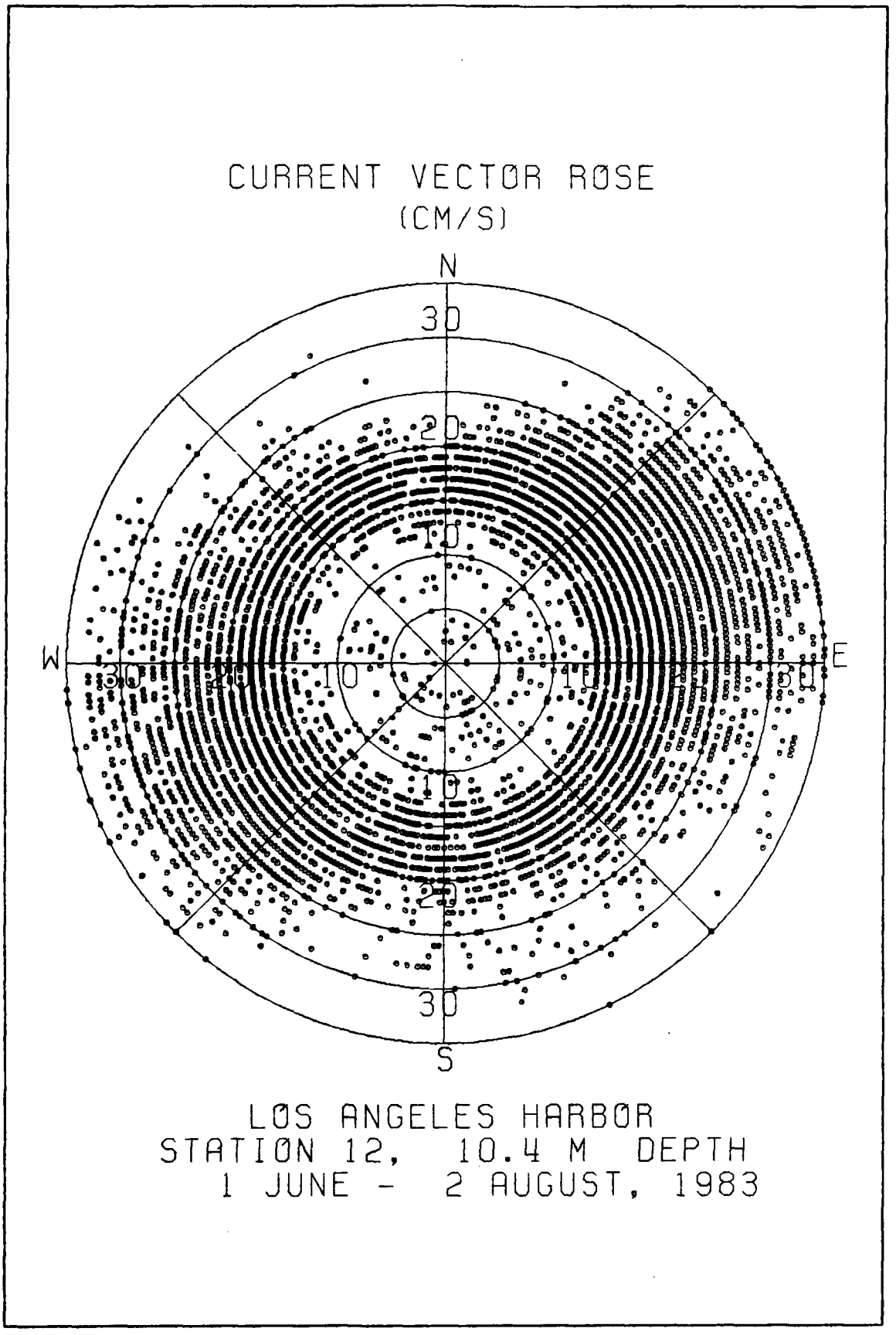
LOS ANGELES HARBOR
STATION 12, 7.3 M DEPTH
1 JUNE - 2 AUGUST, 1983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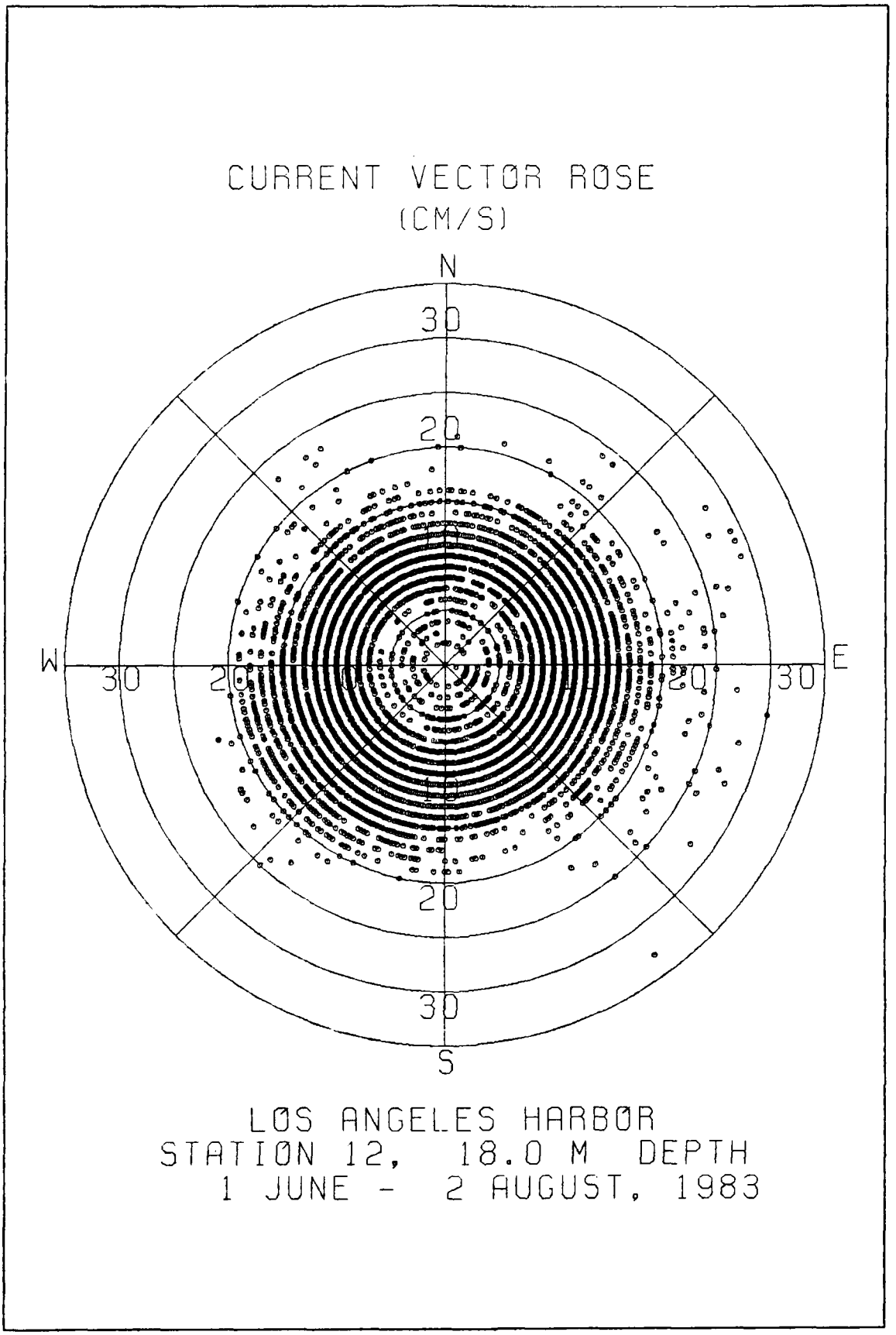
1 JUNE - 2 AUGUST, 1983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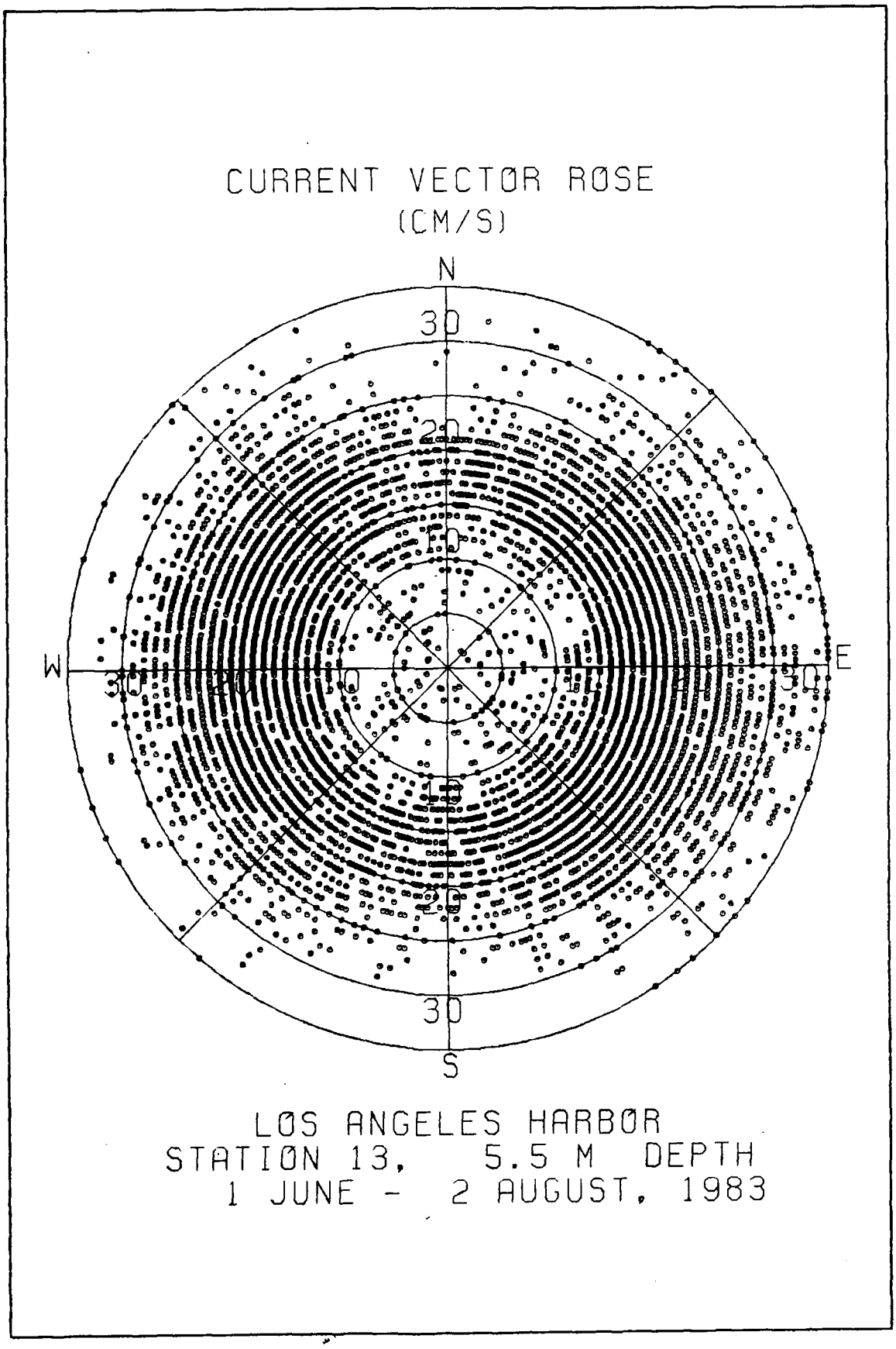
1 JUNE - 2 AUGUST, 1983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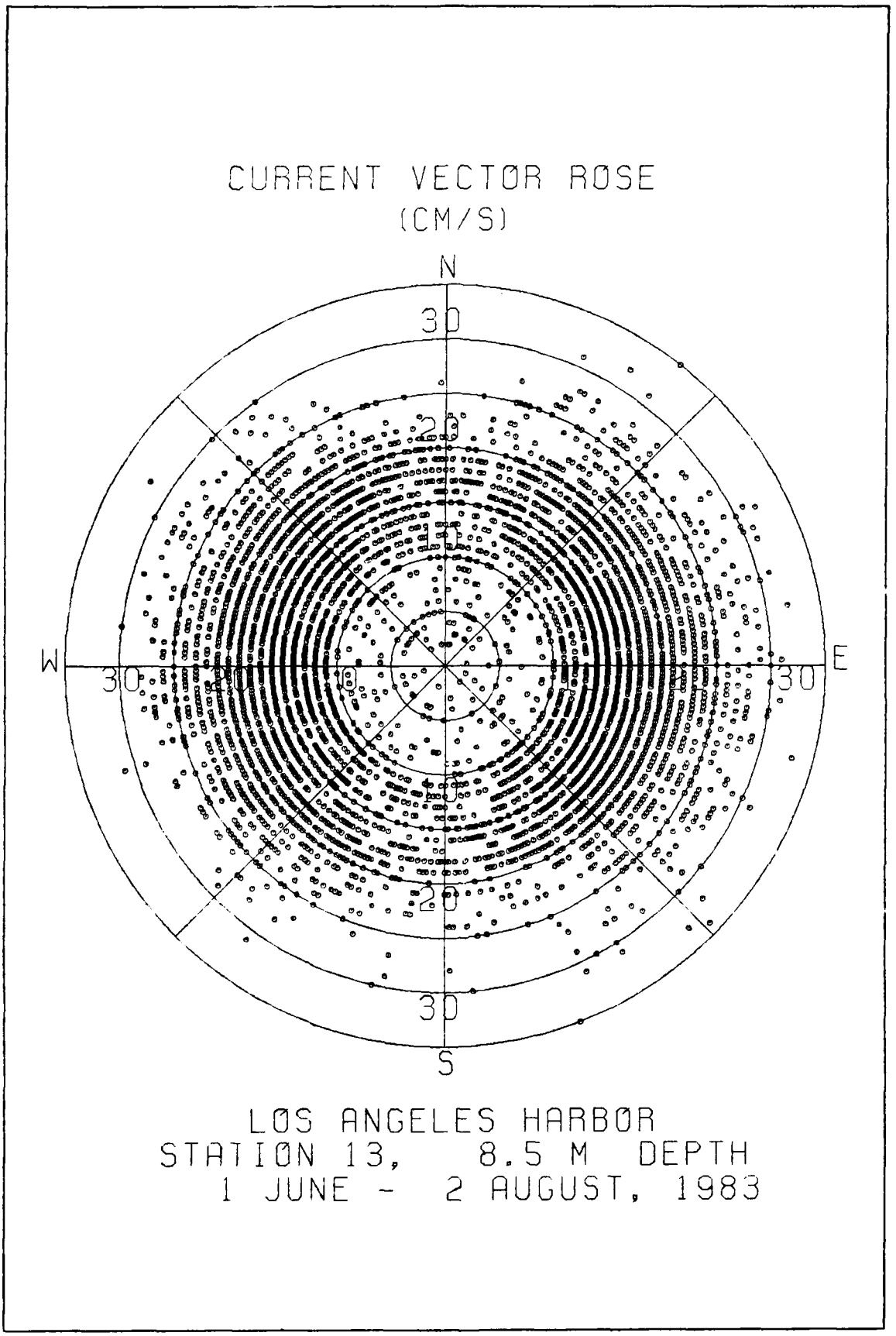
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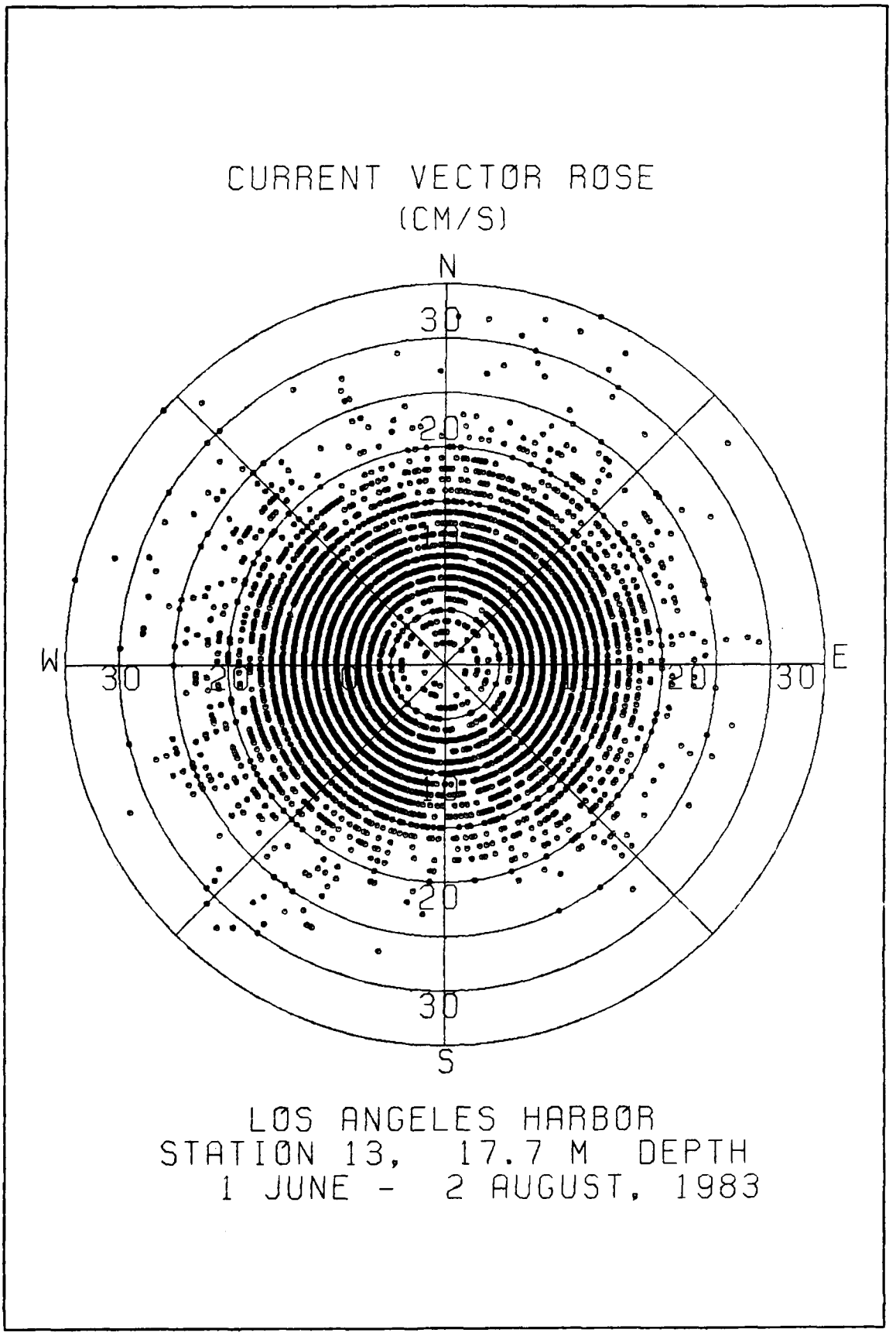
1 JUNE - 2 AUGUST, 1983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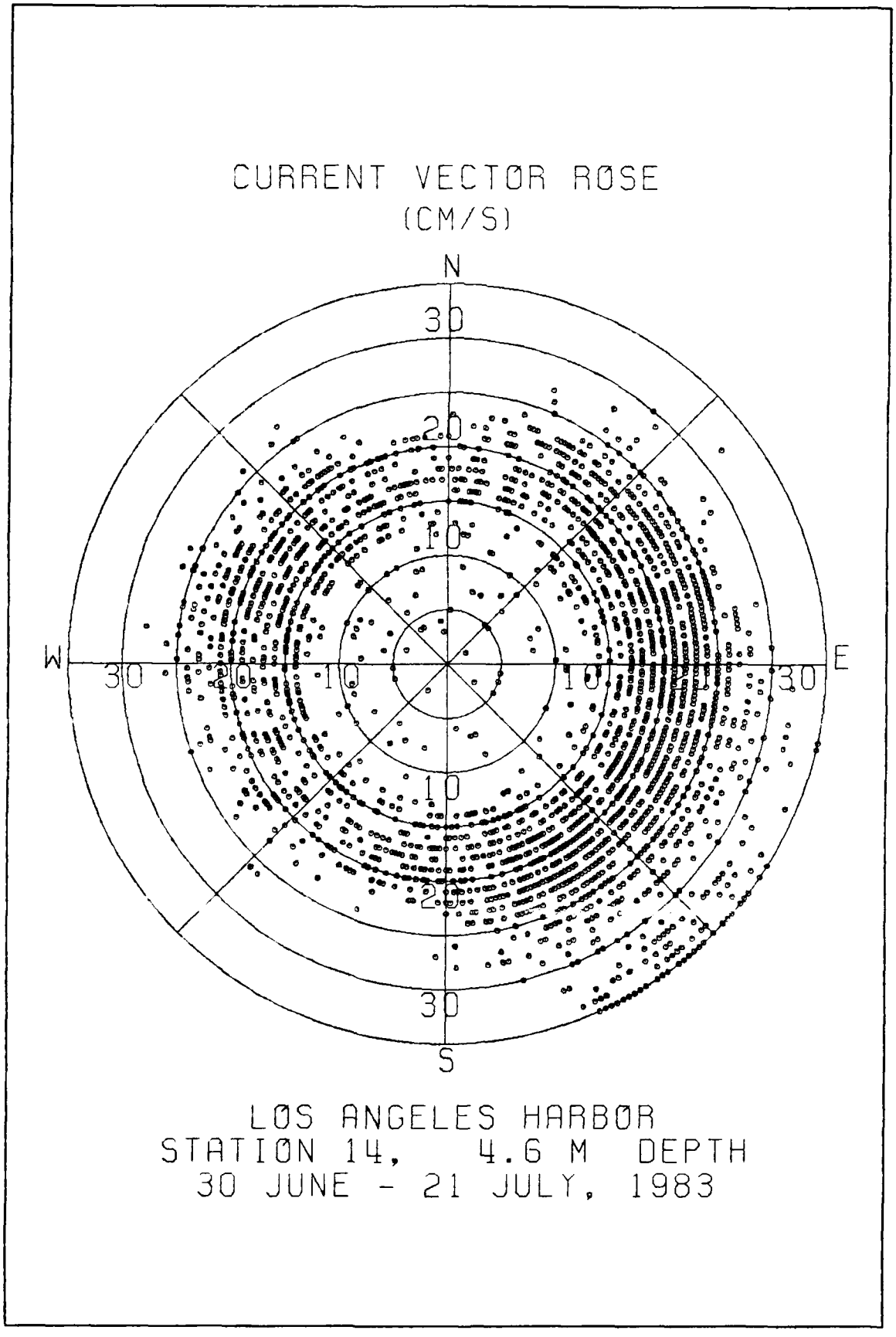
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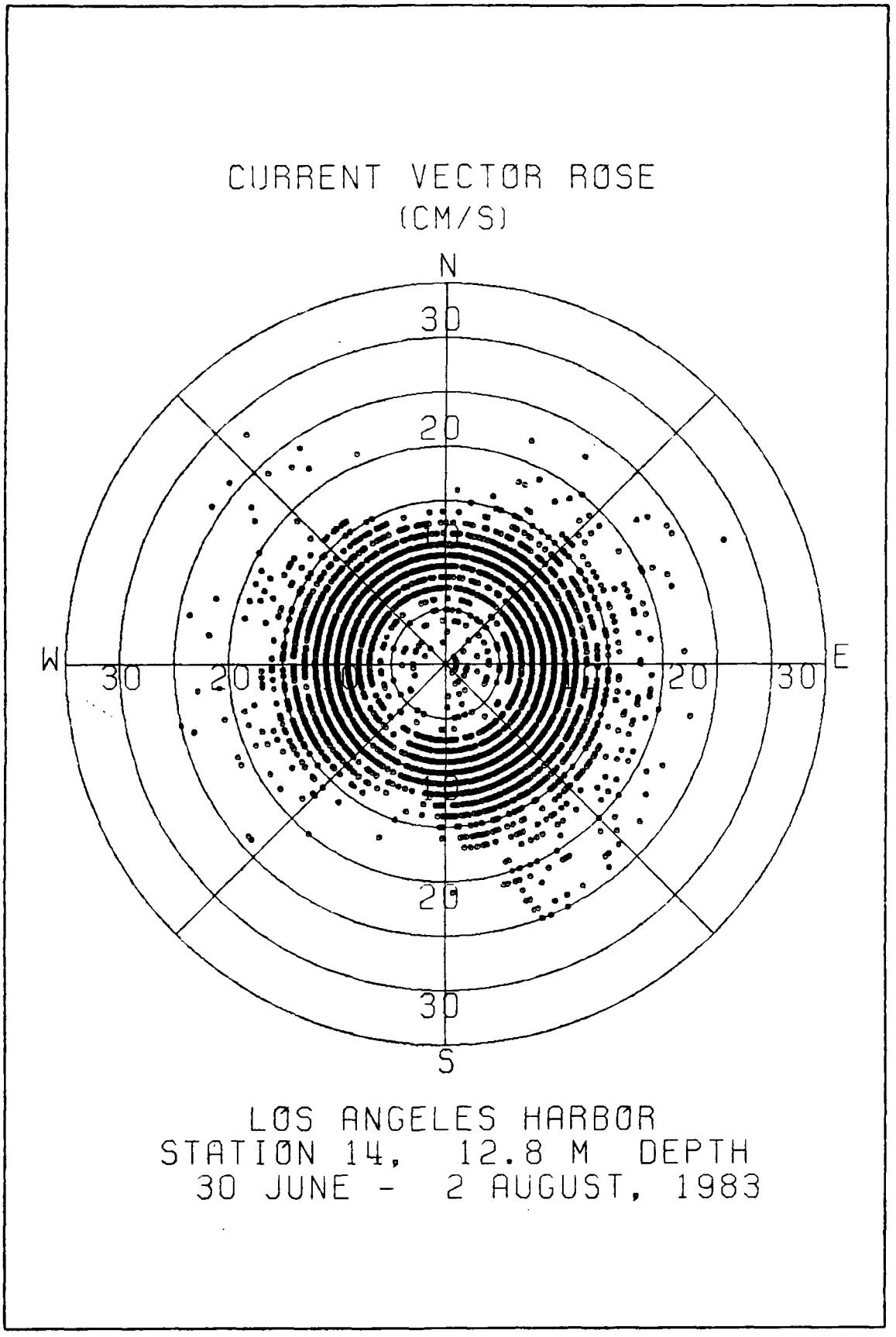
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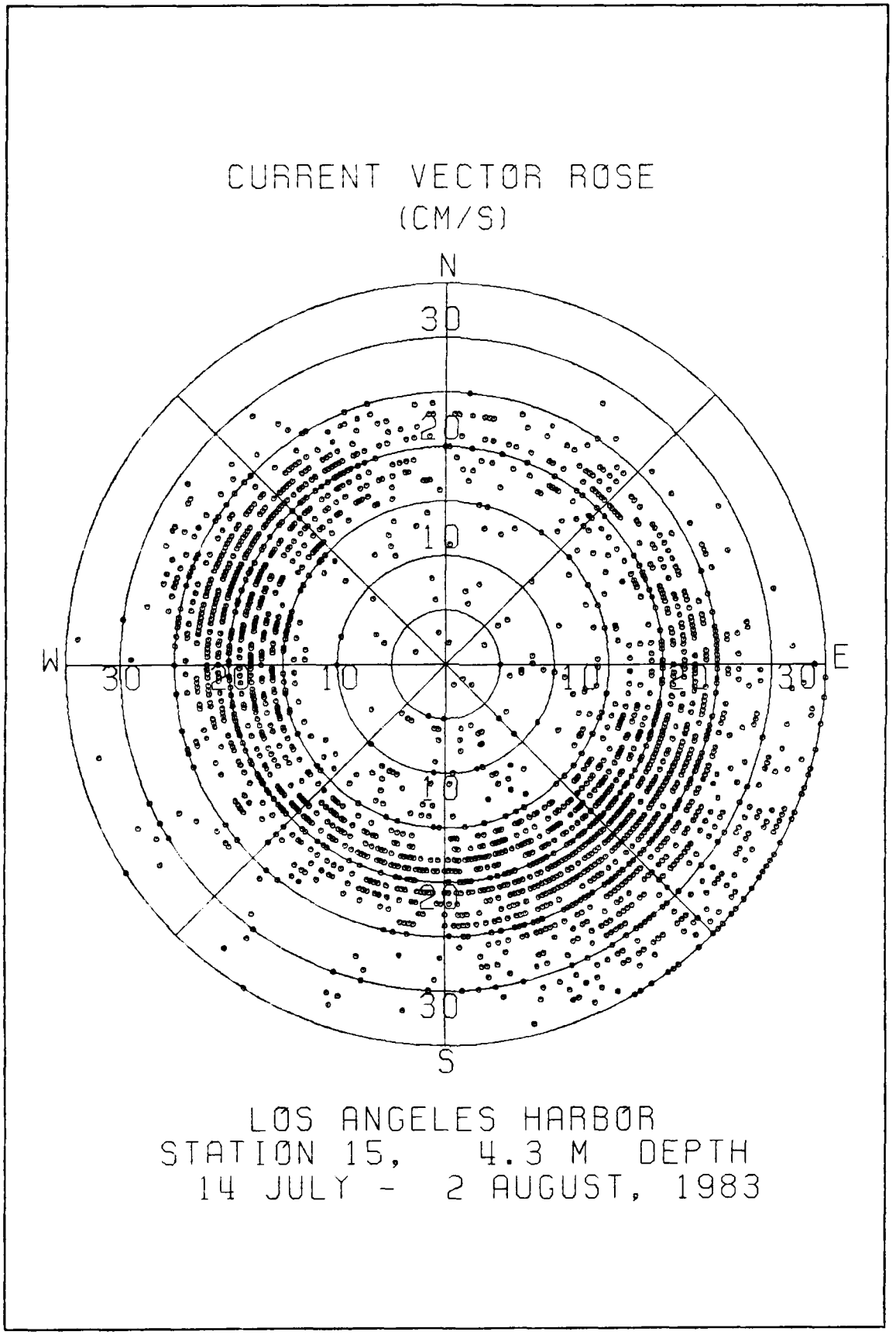
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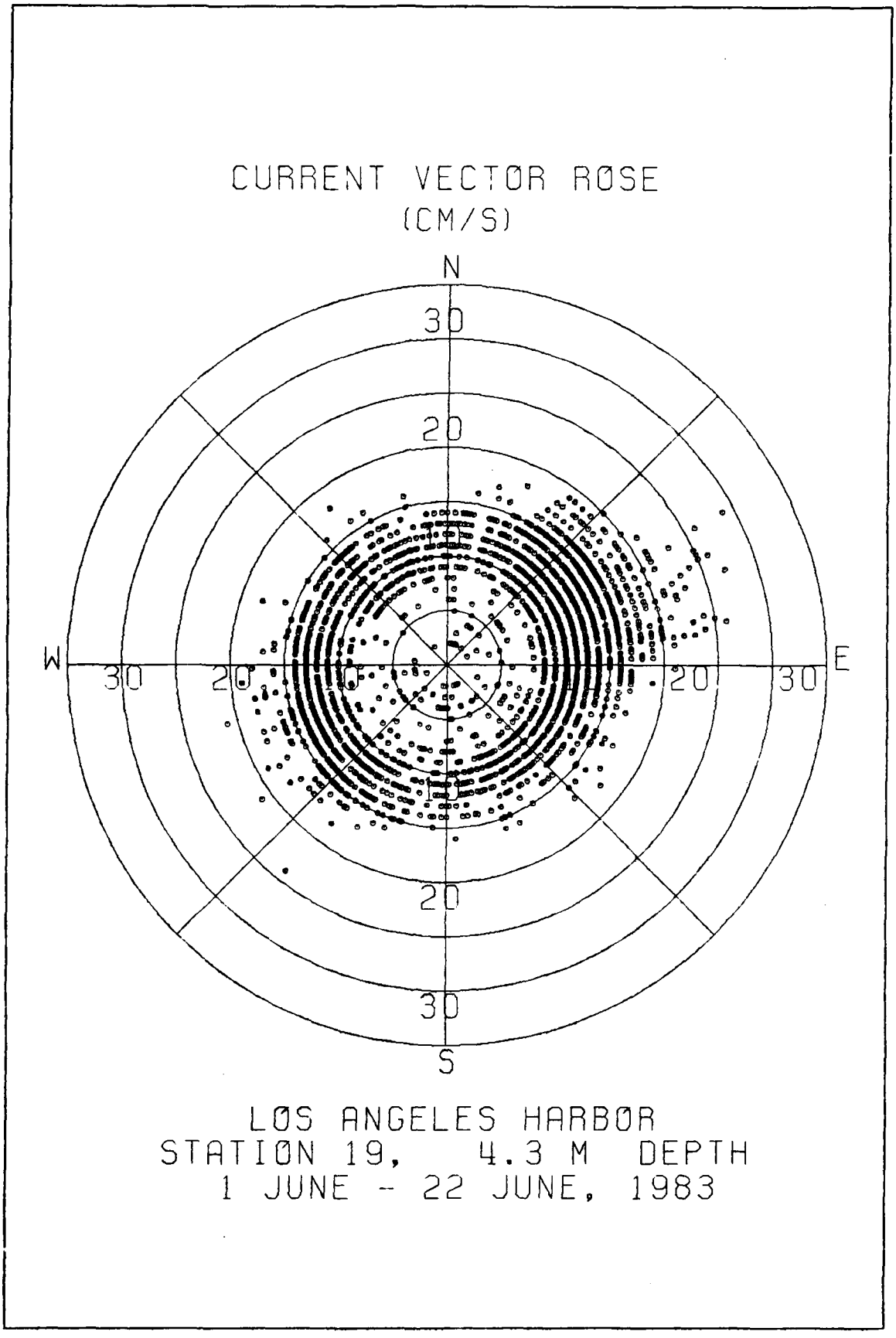
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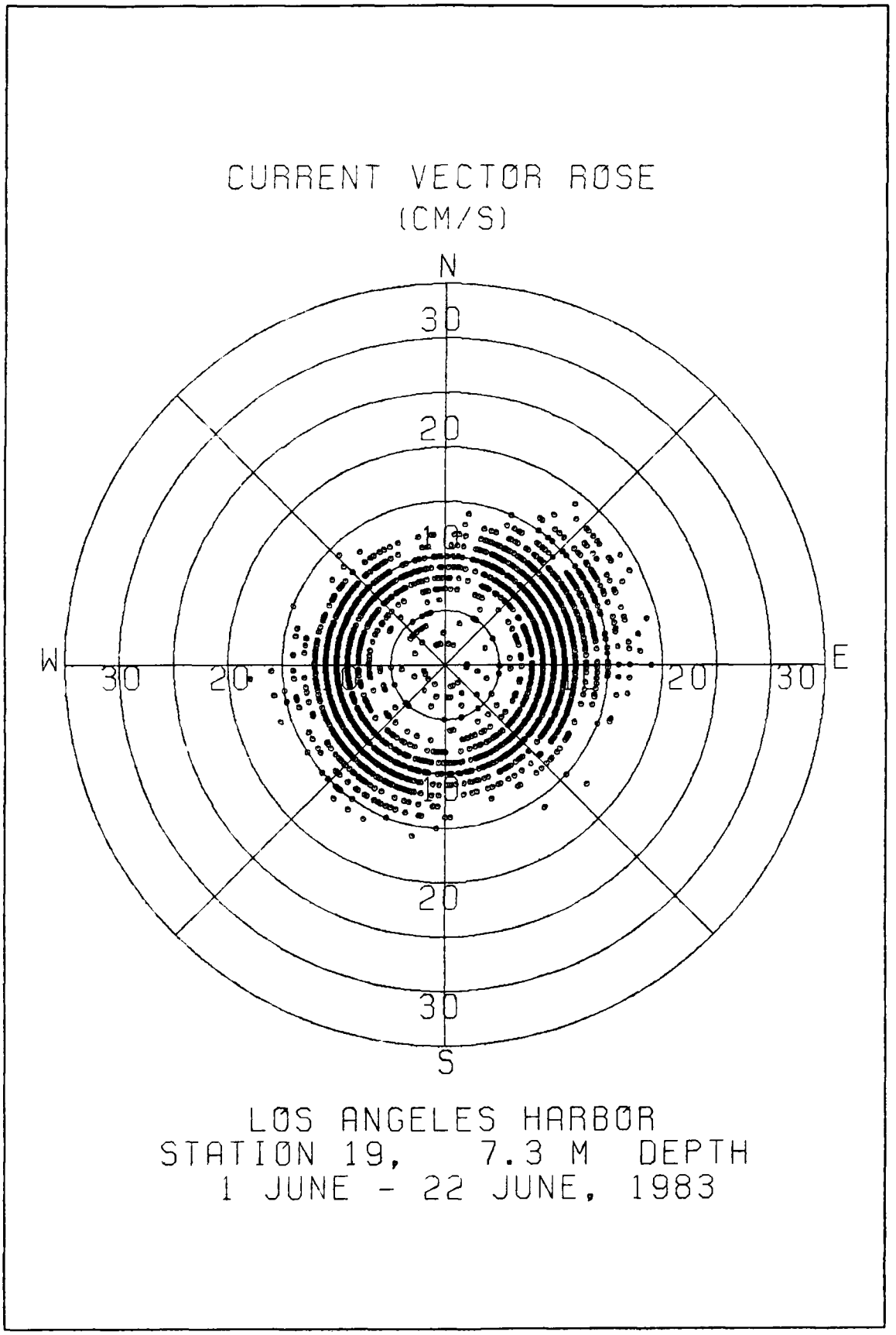
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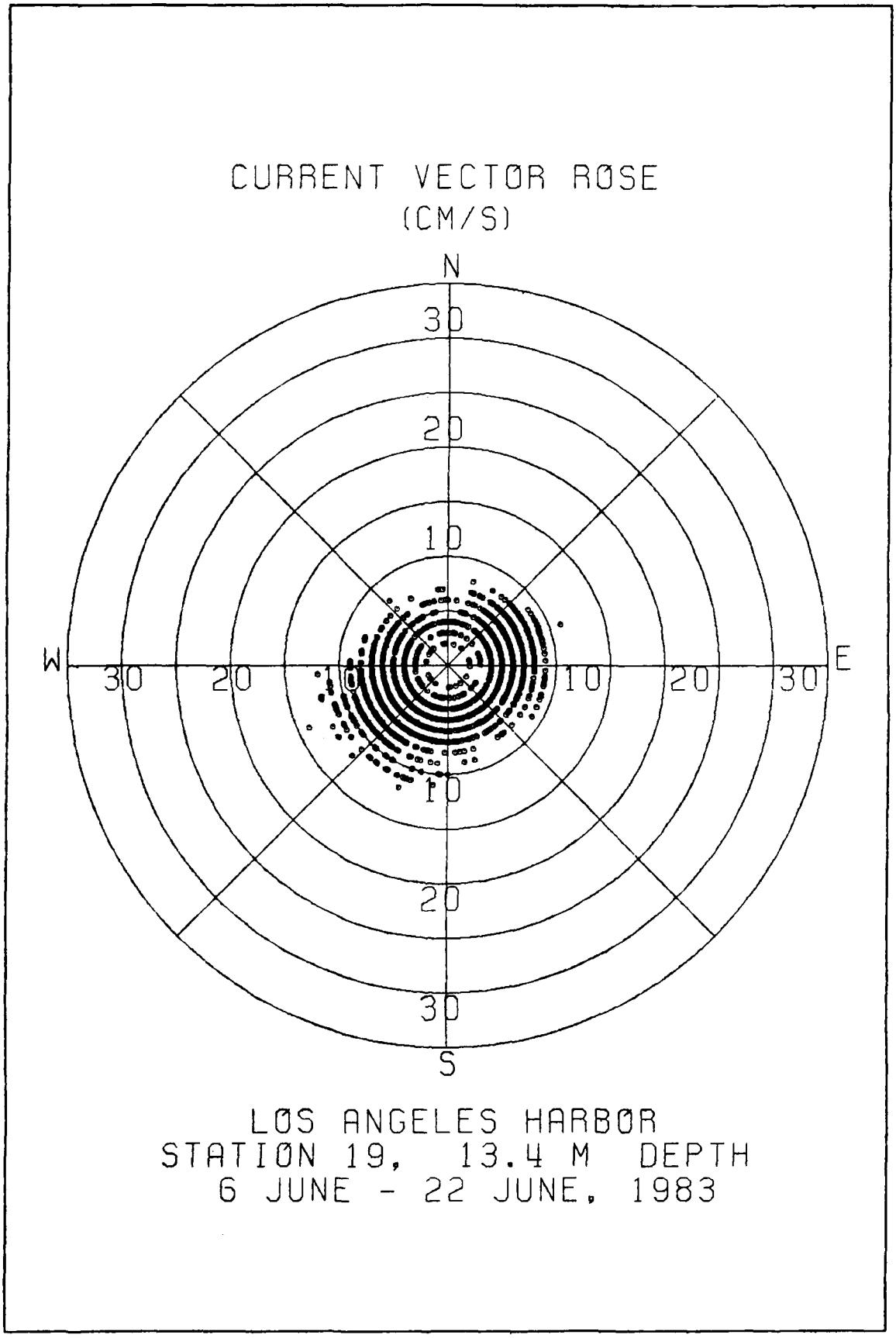
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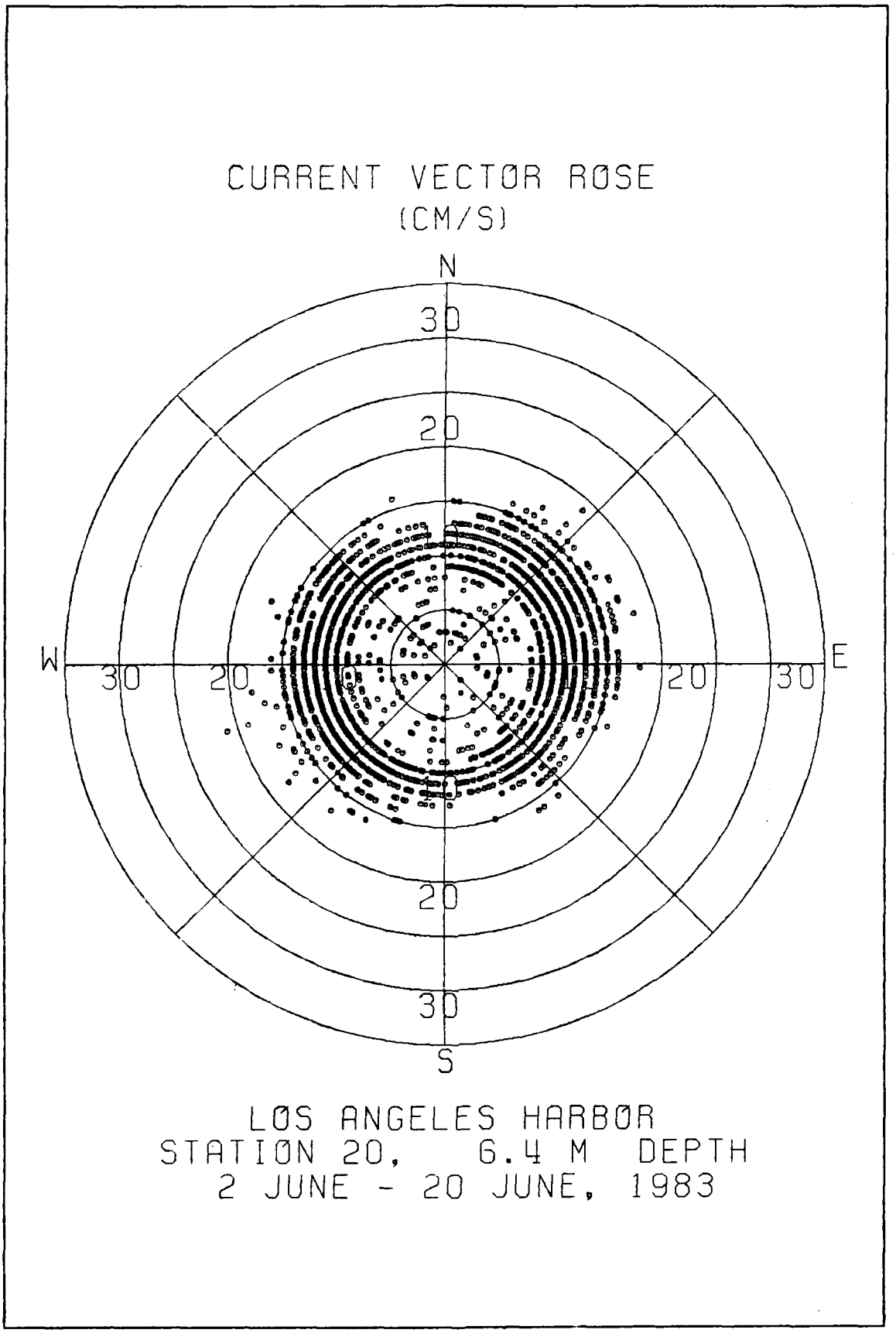
6 JUNE - 22 JUNE, 1983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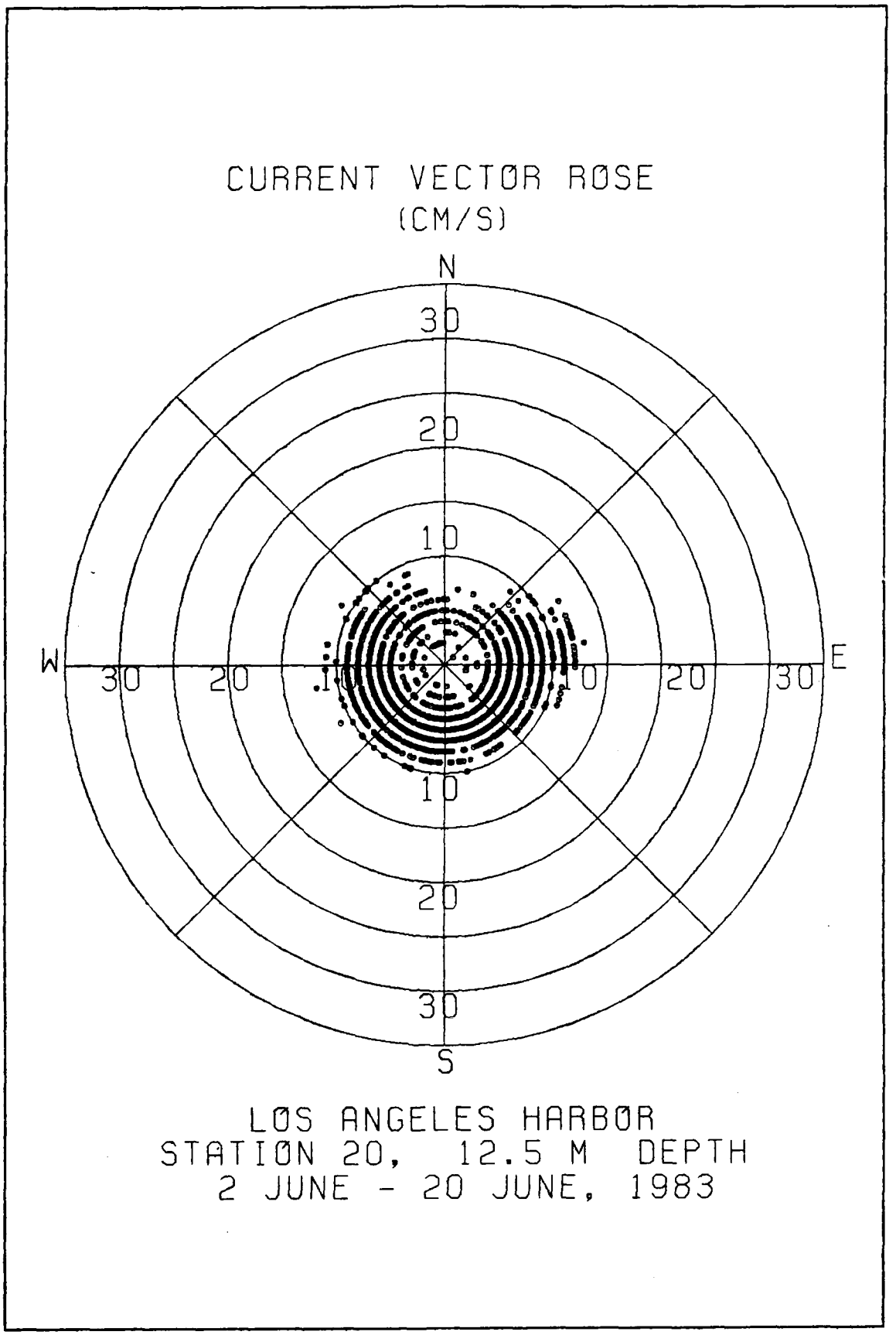
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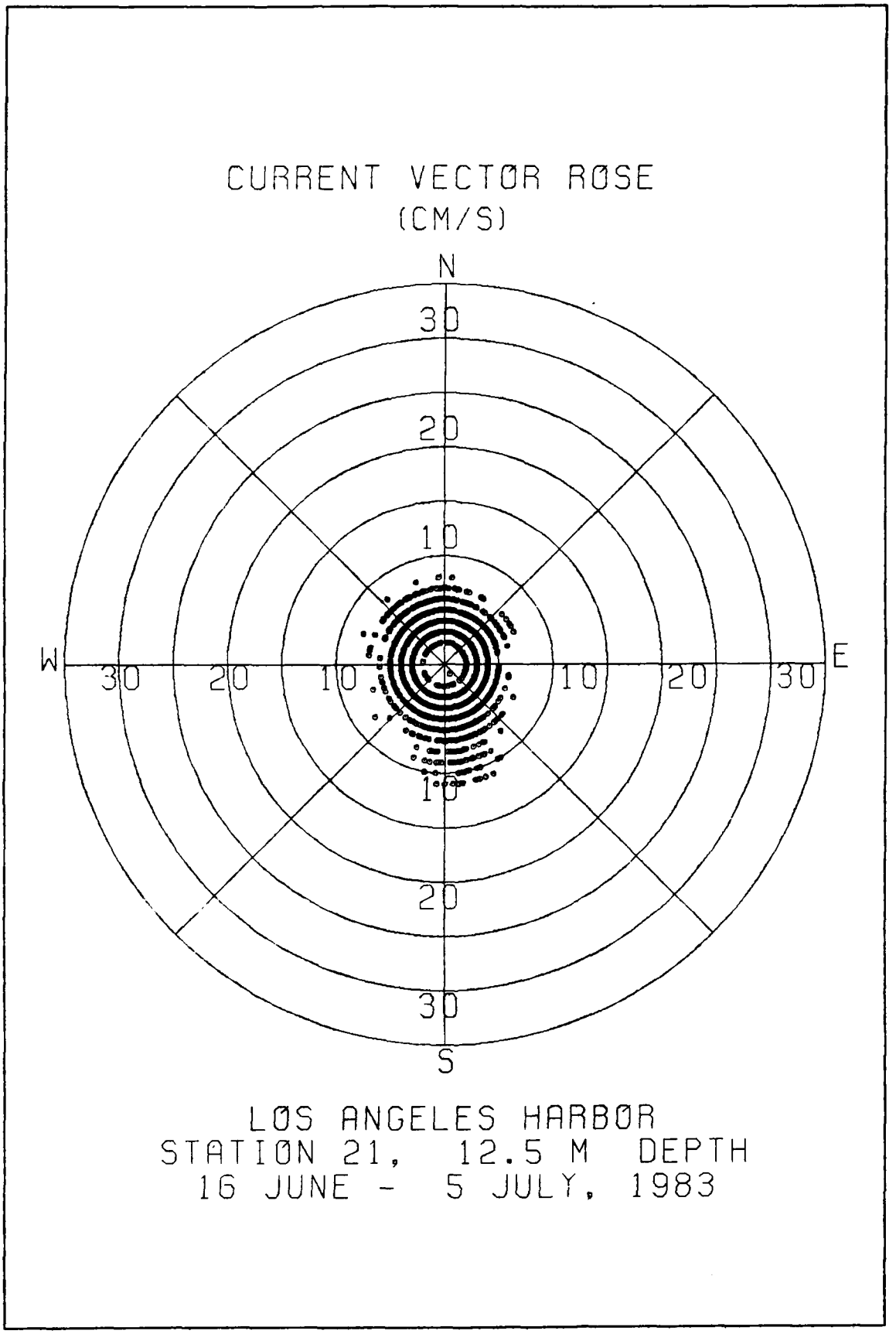
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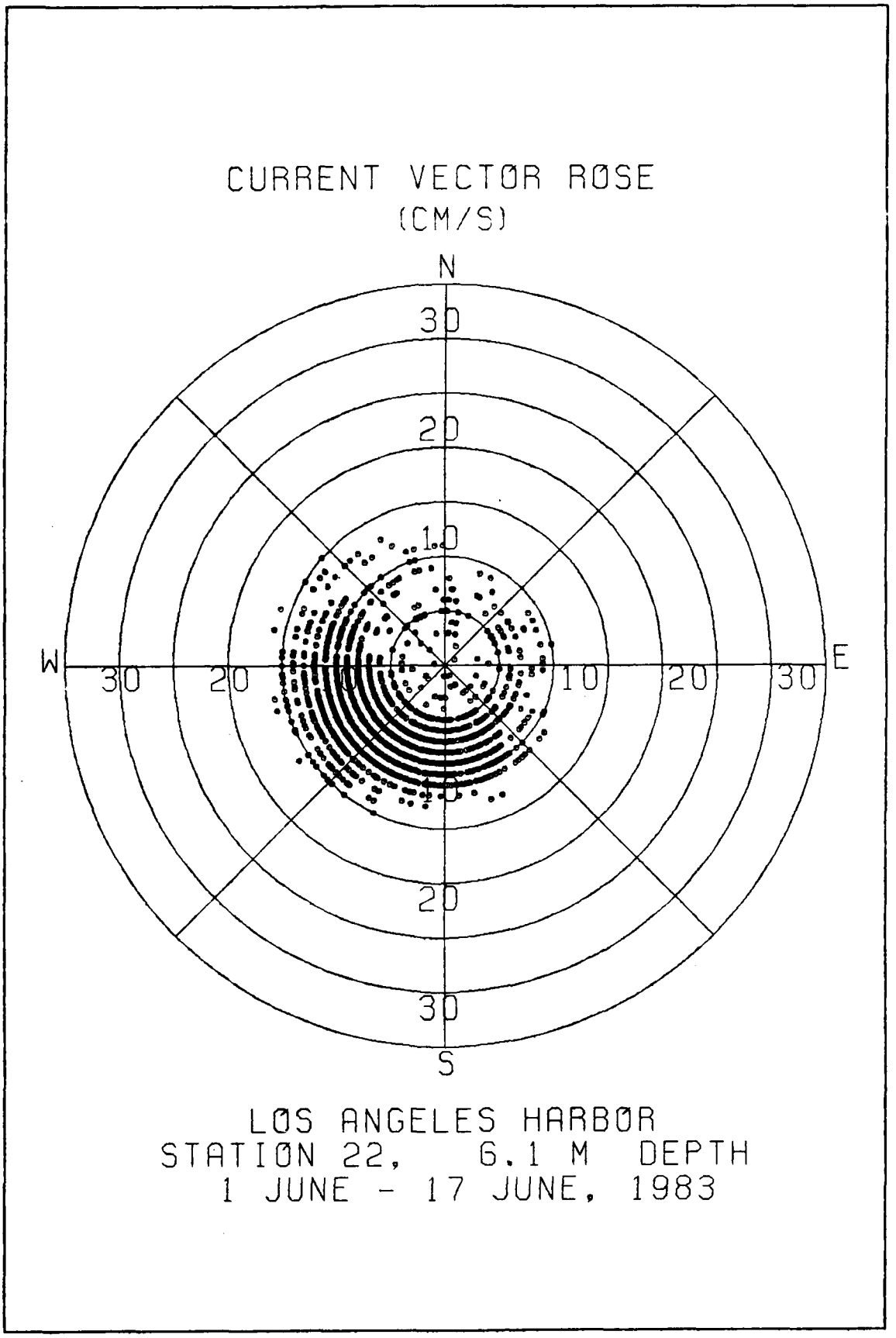
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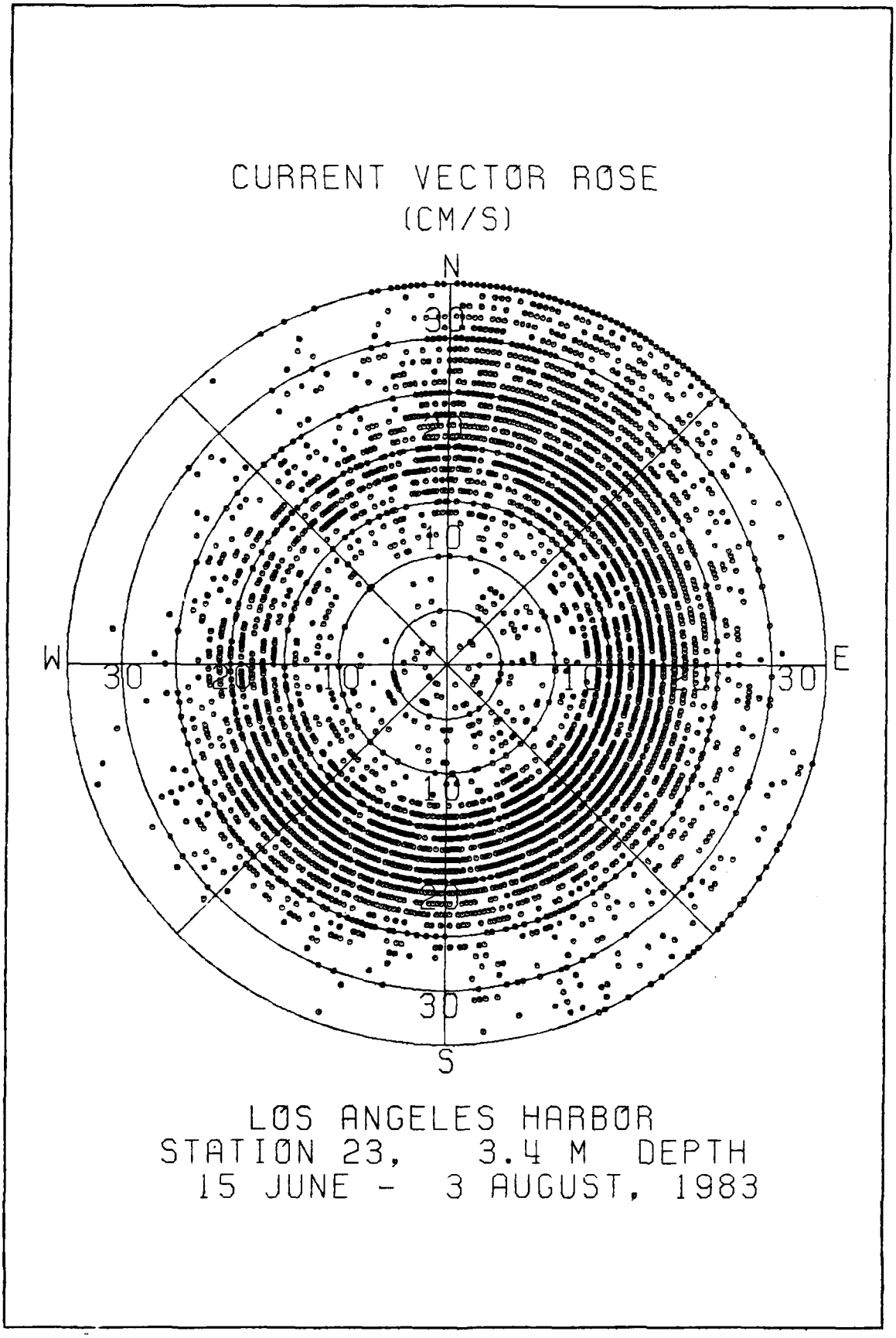
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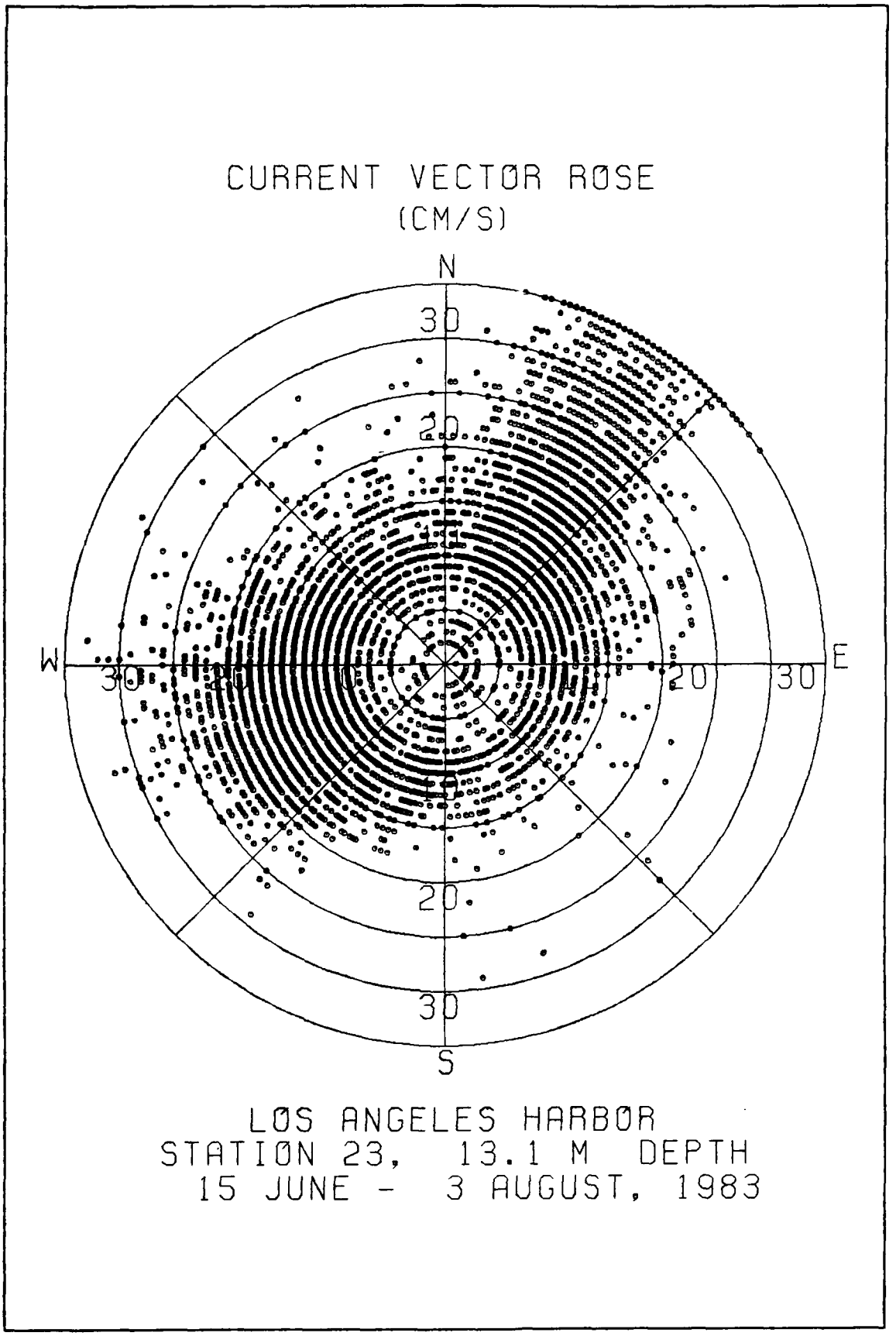
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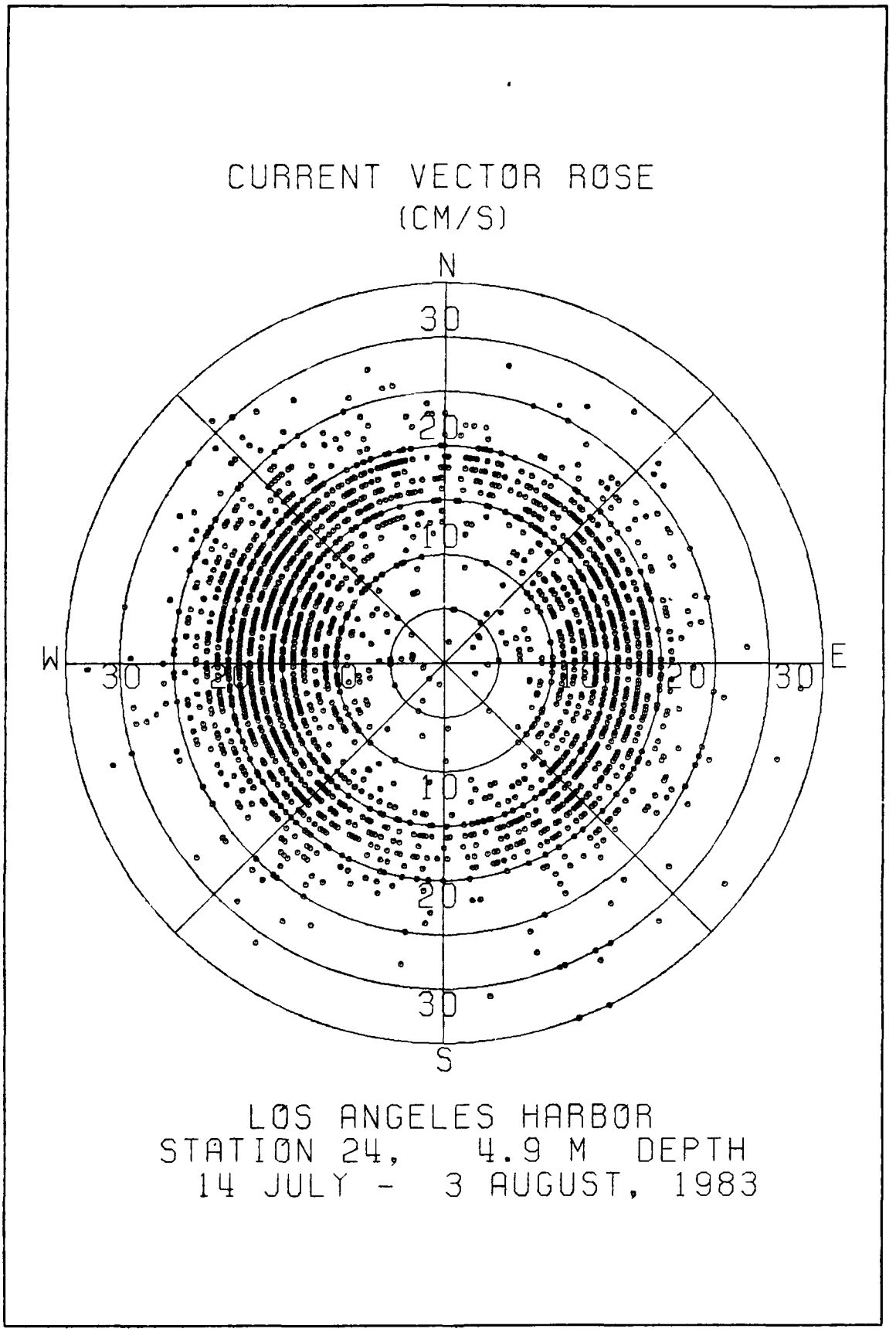
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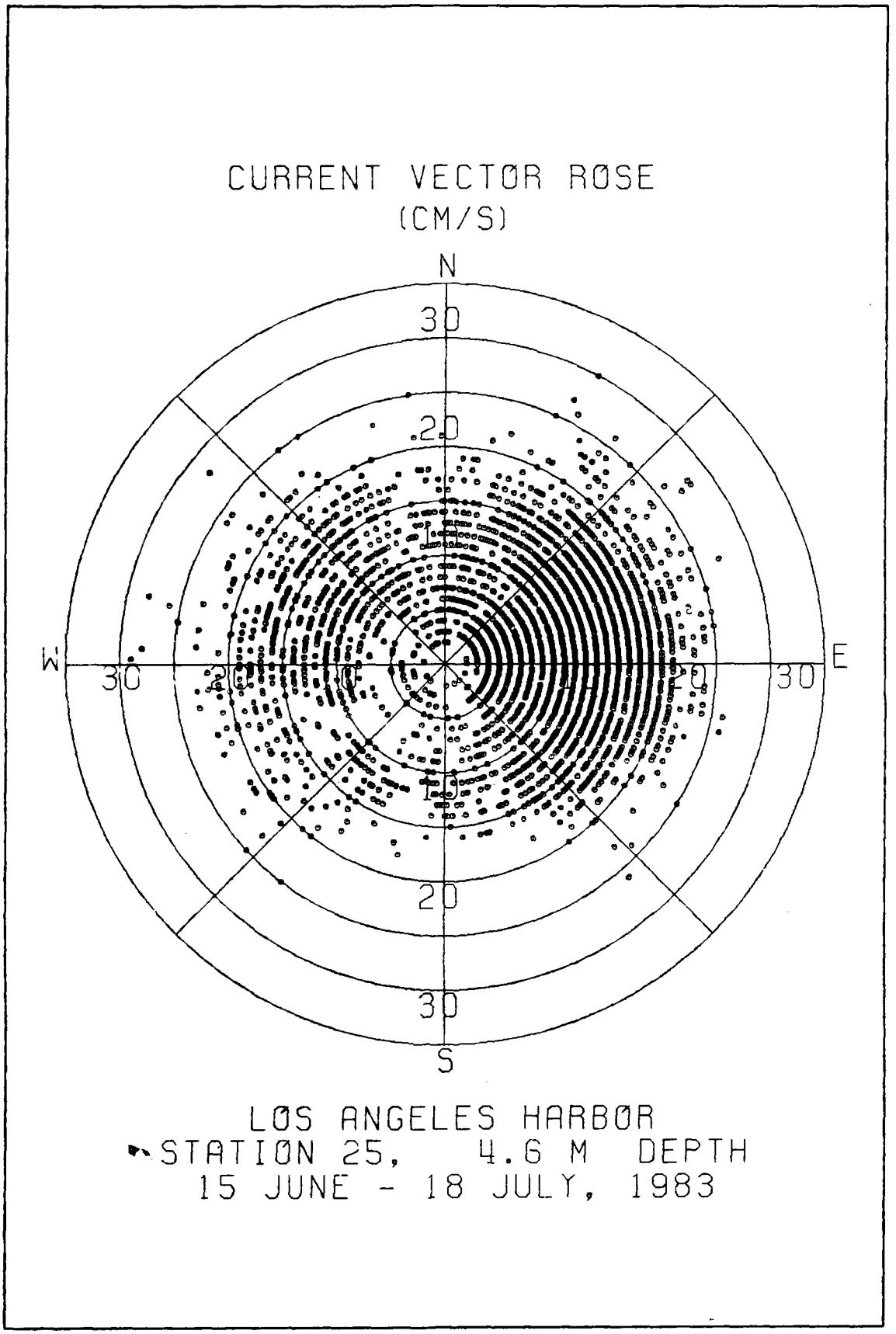
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STATION 25, 4.6 M DEPTH
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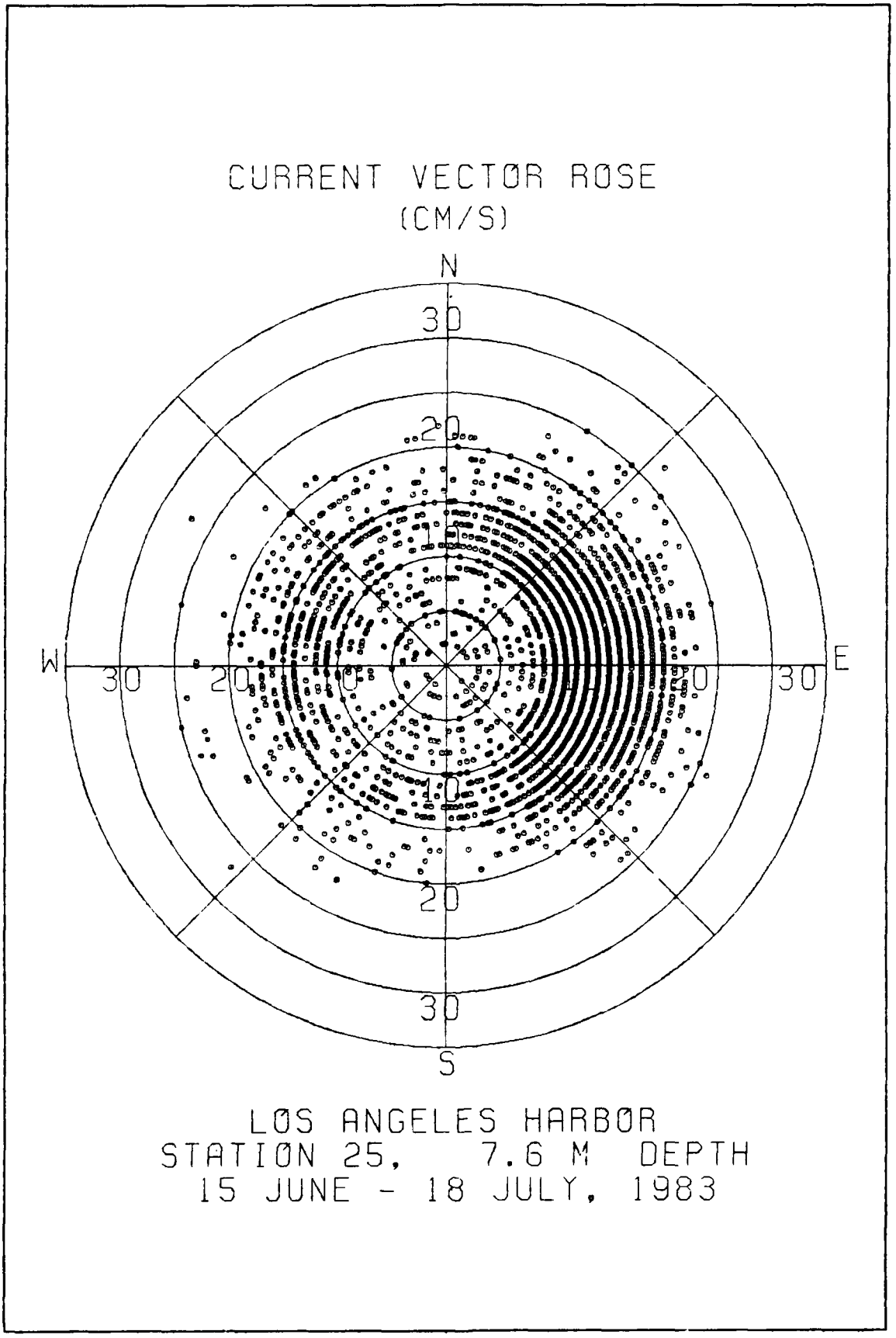
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STATION 25, 7.6 M DEPTH
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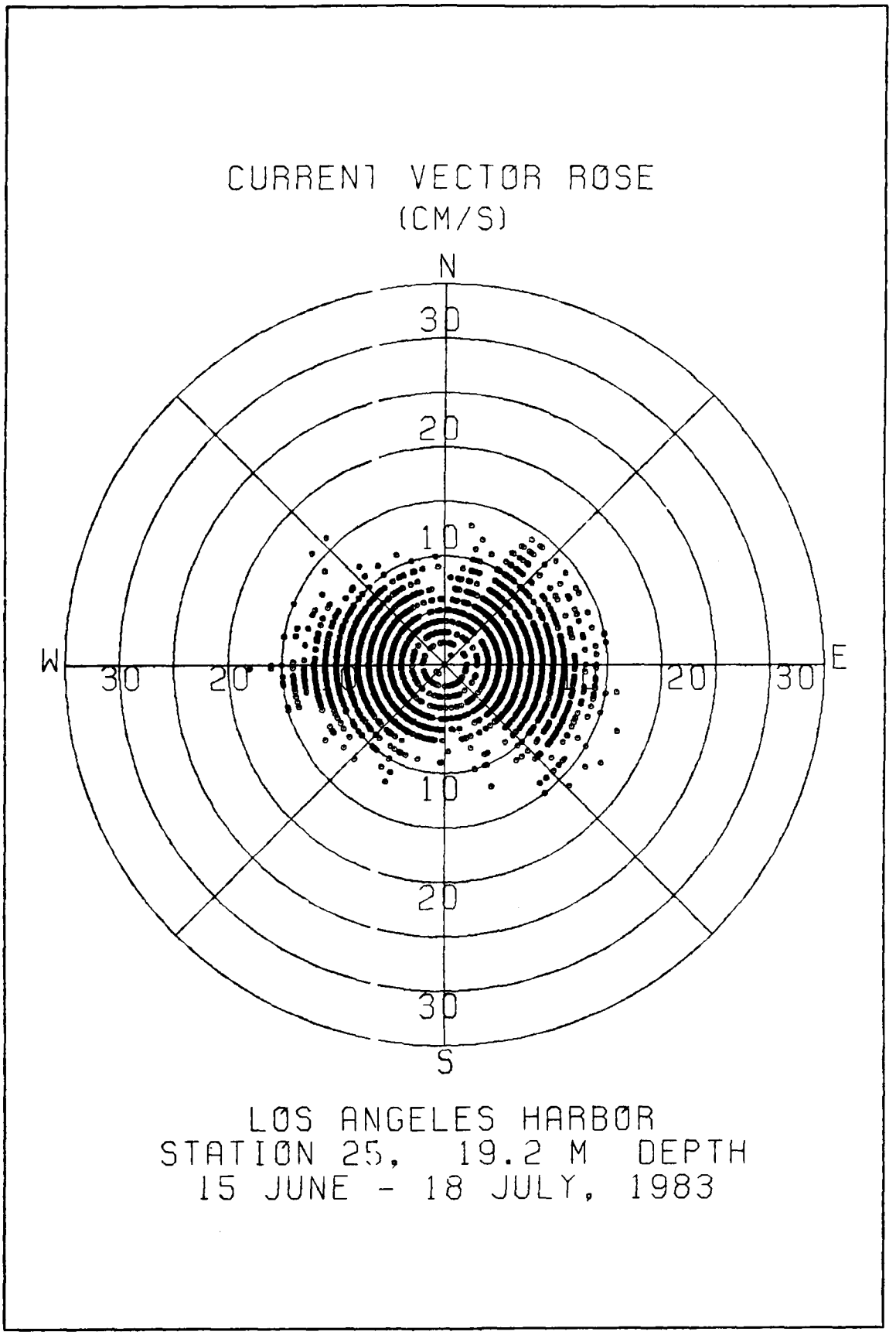
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STATION 25, 19.2 M DEPTH
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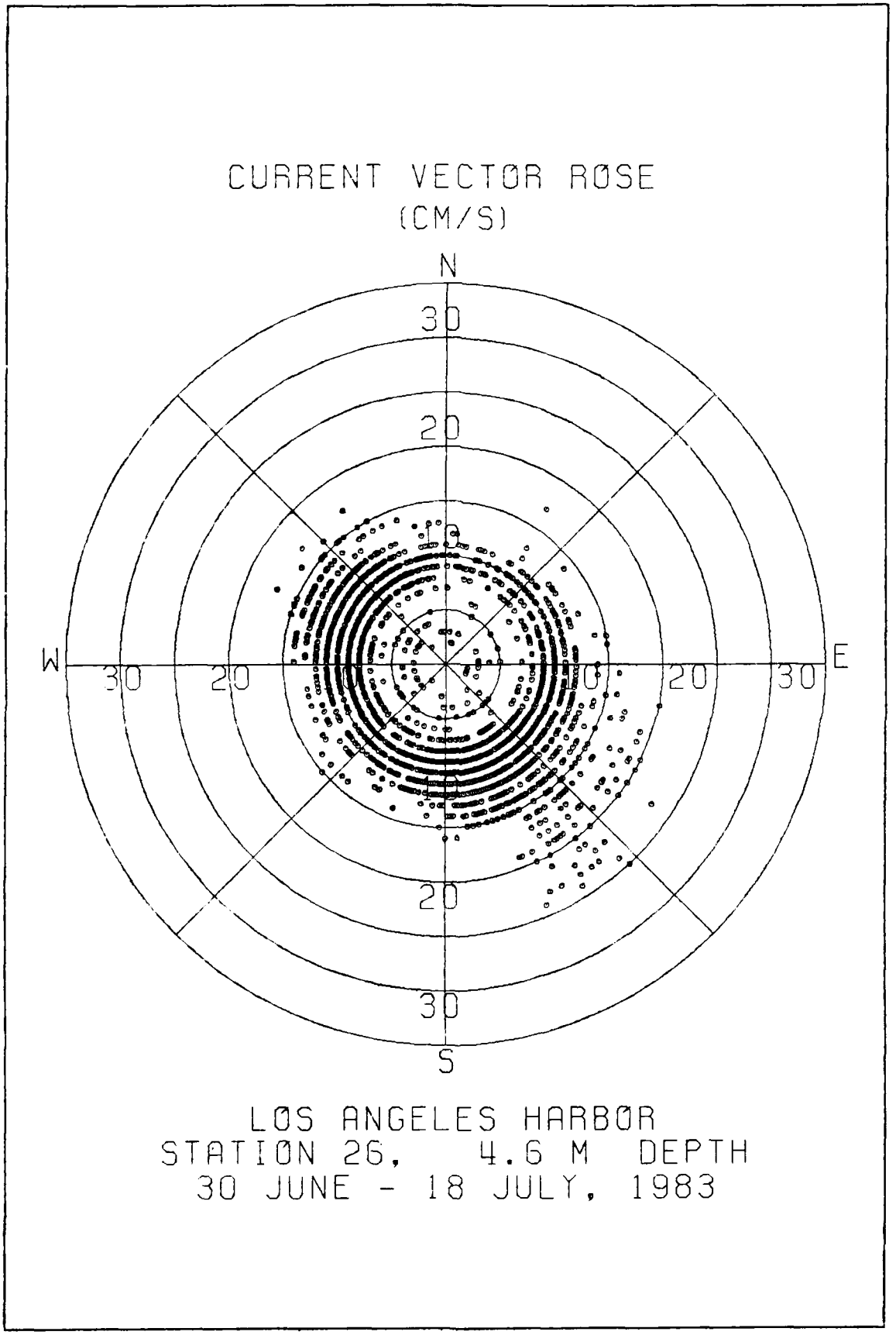
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STATION 26, 4.6 M DEPTH
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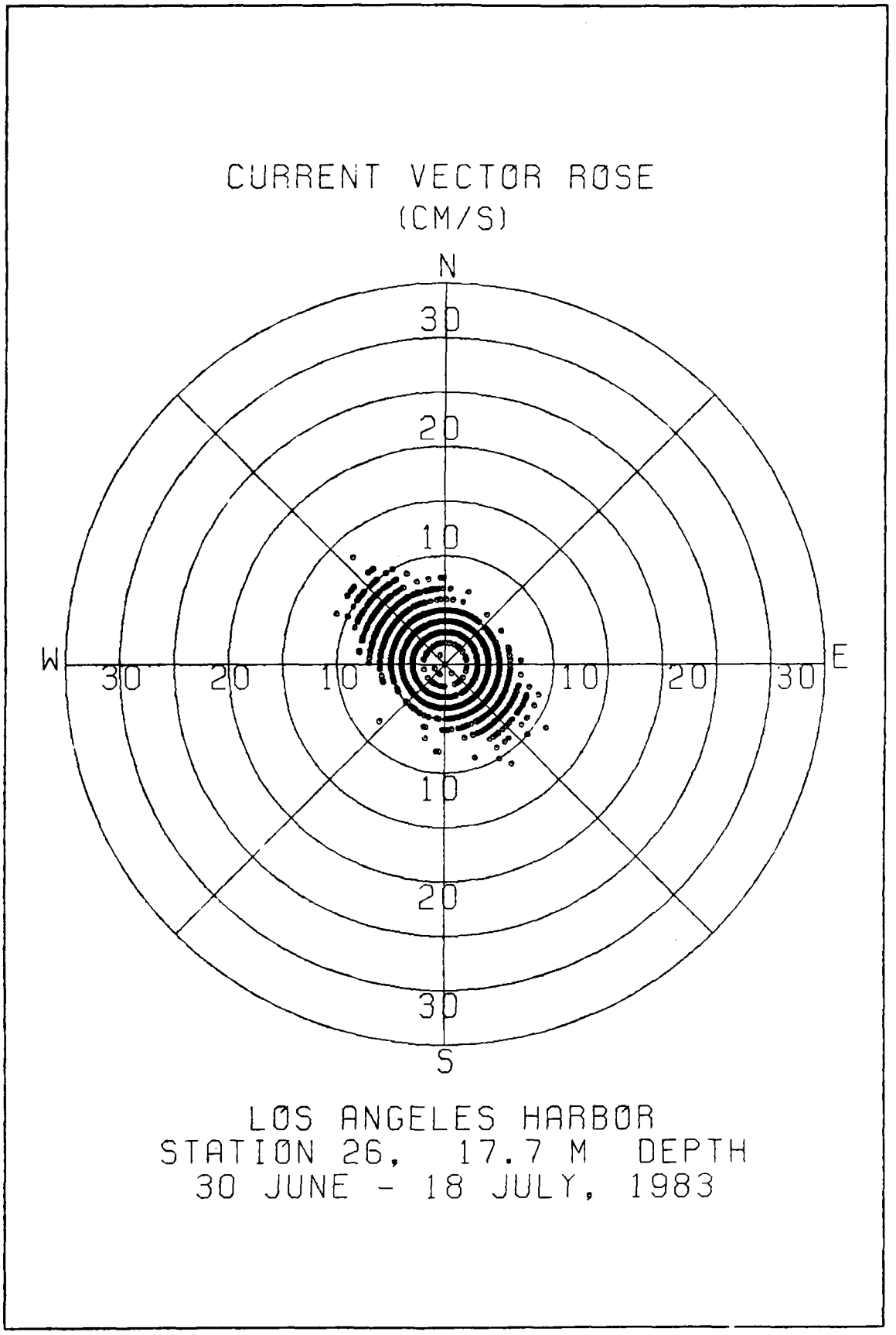
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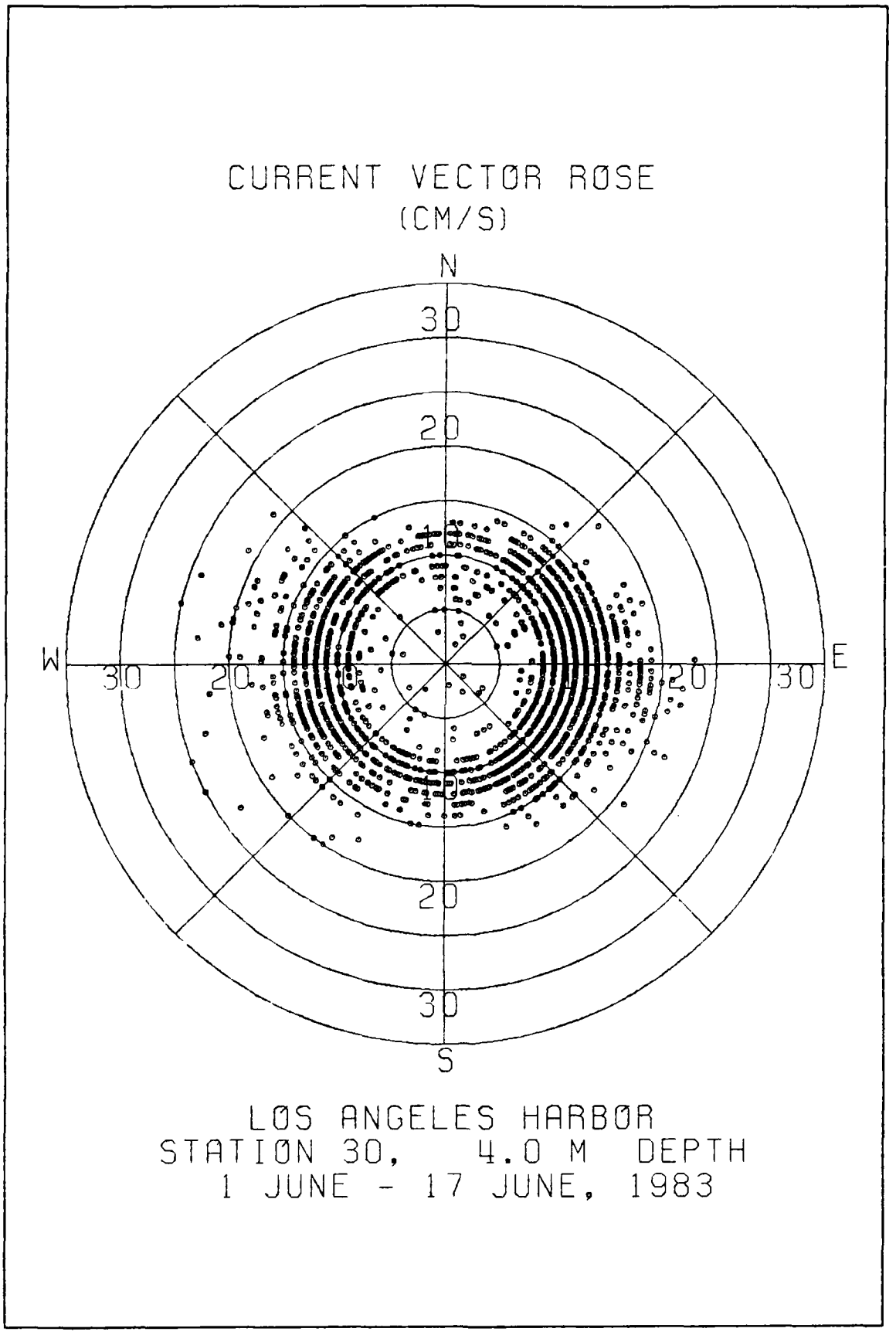
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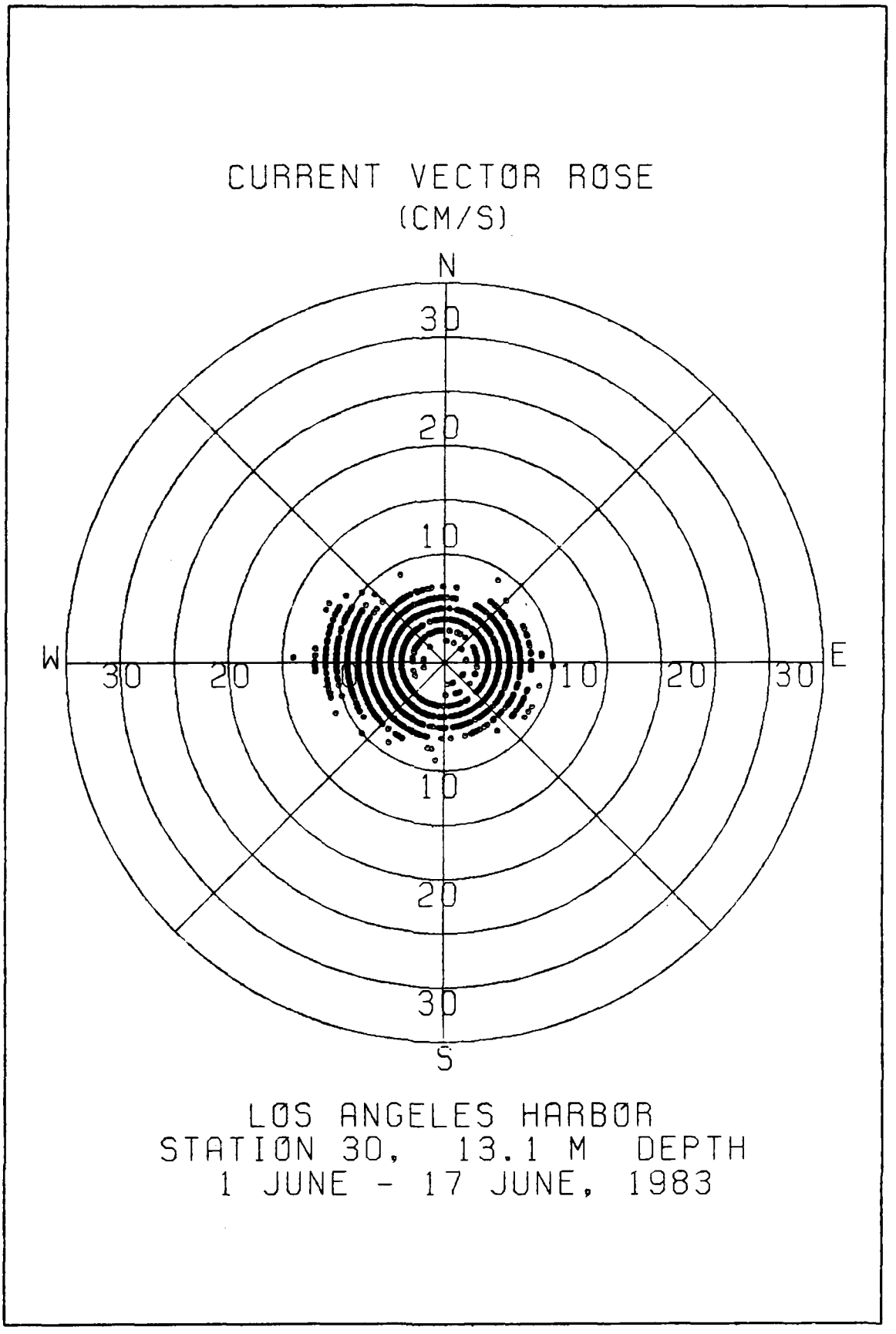
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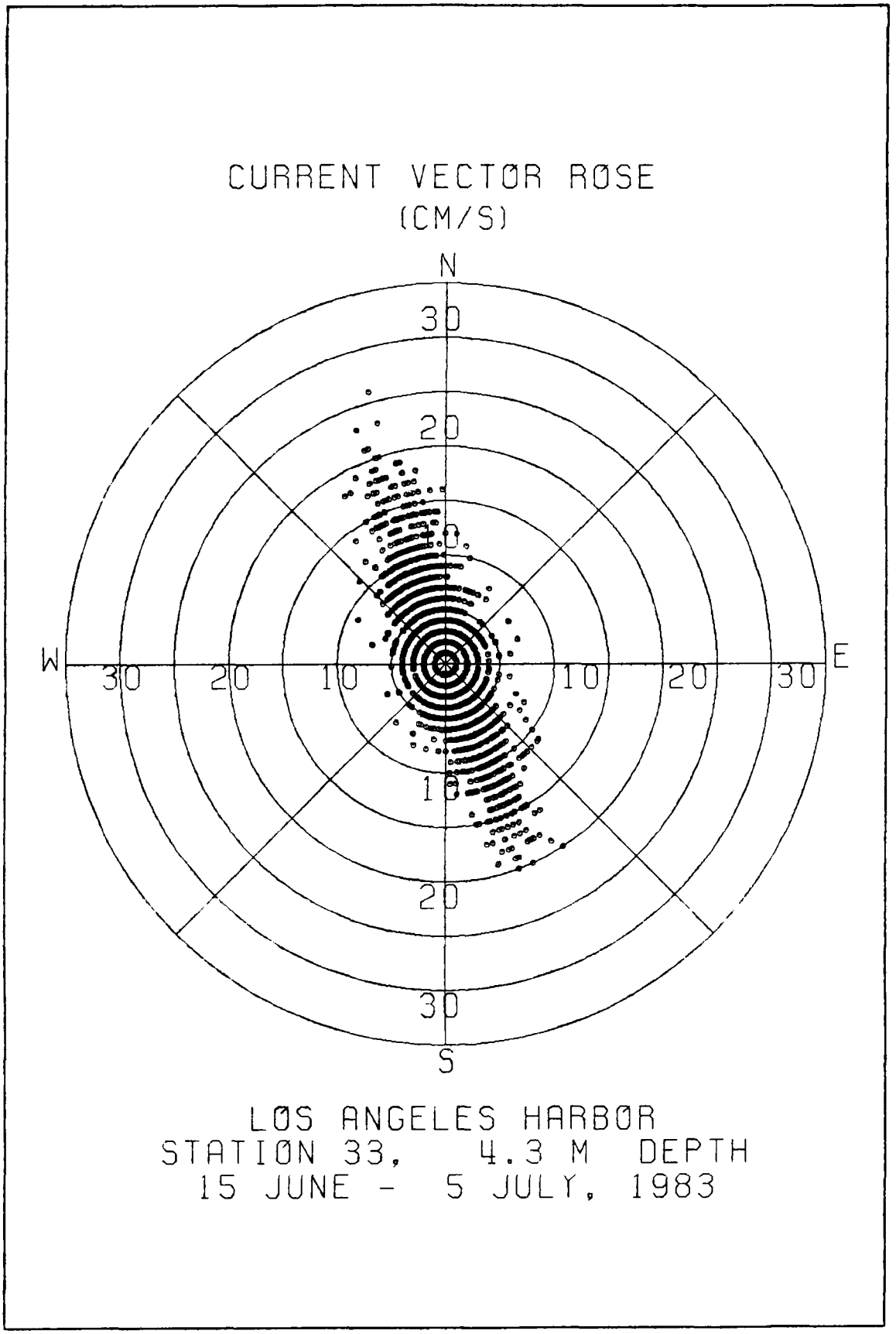
1 JUNE - 17 JUNE, 1983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STATION 33, 4.3 M DEPTH
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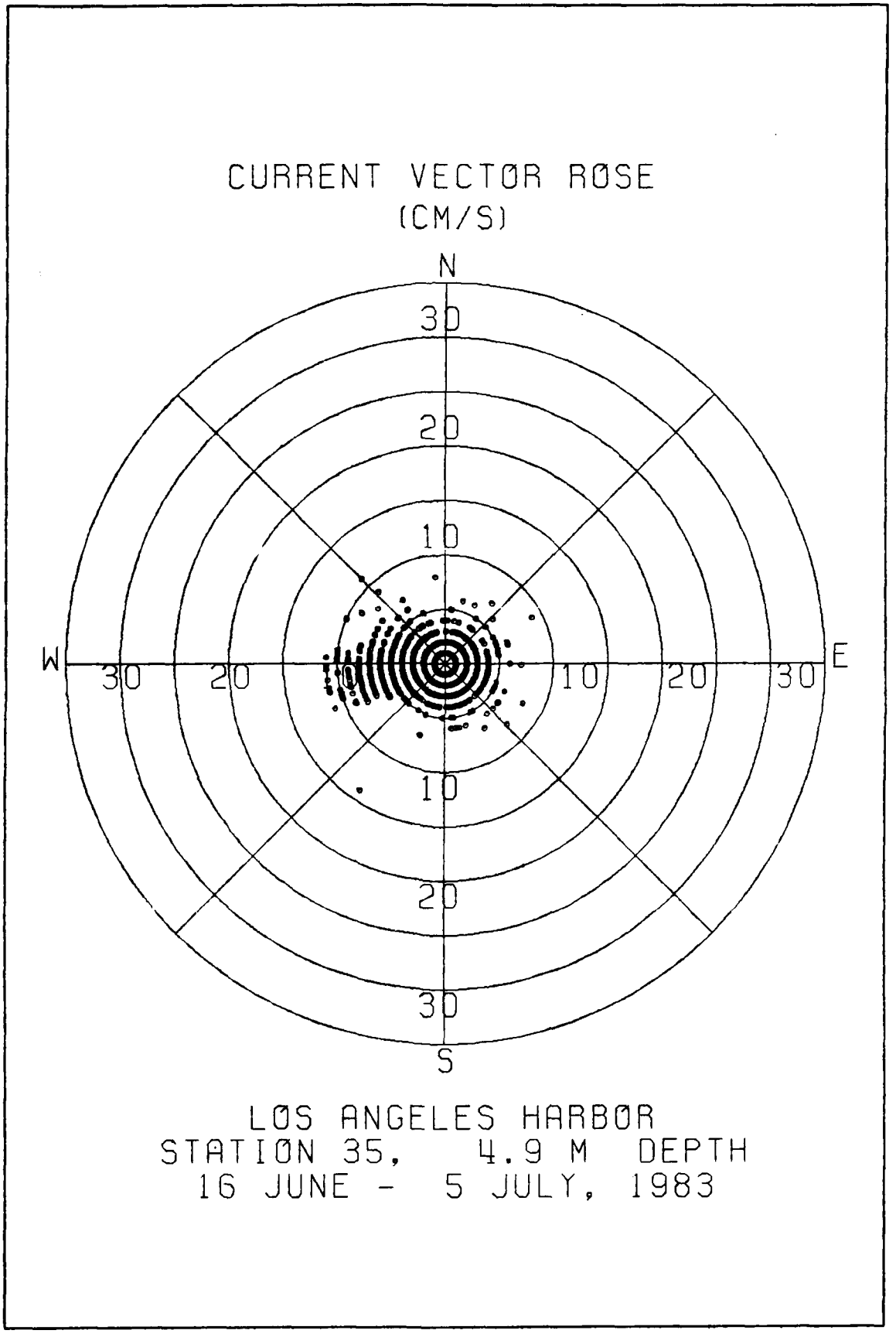
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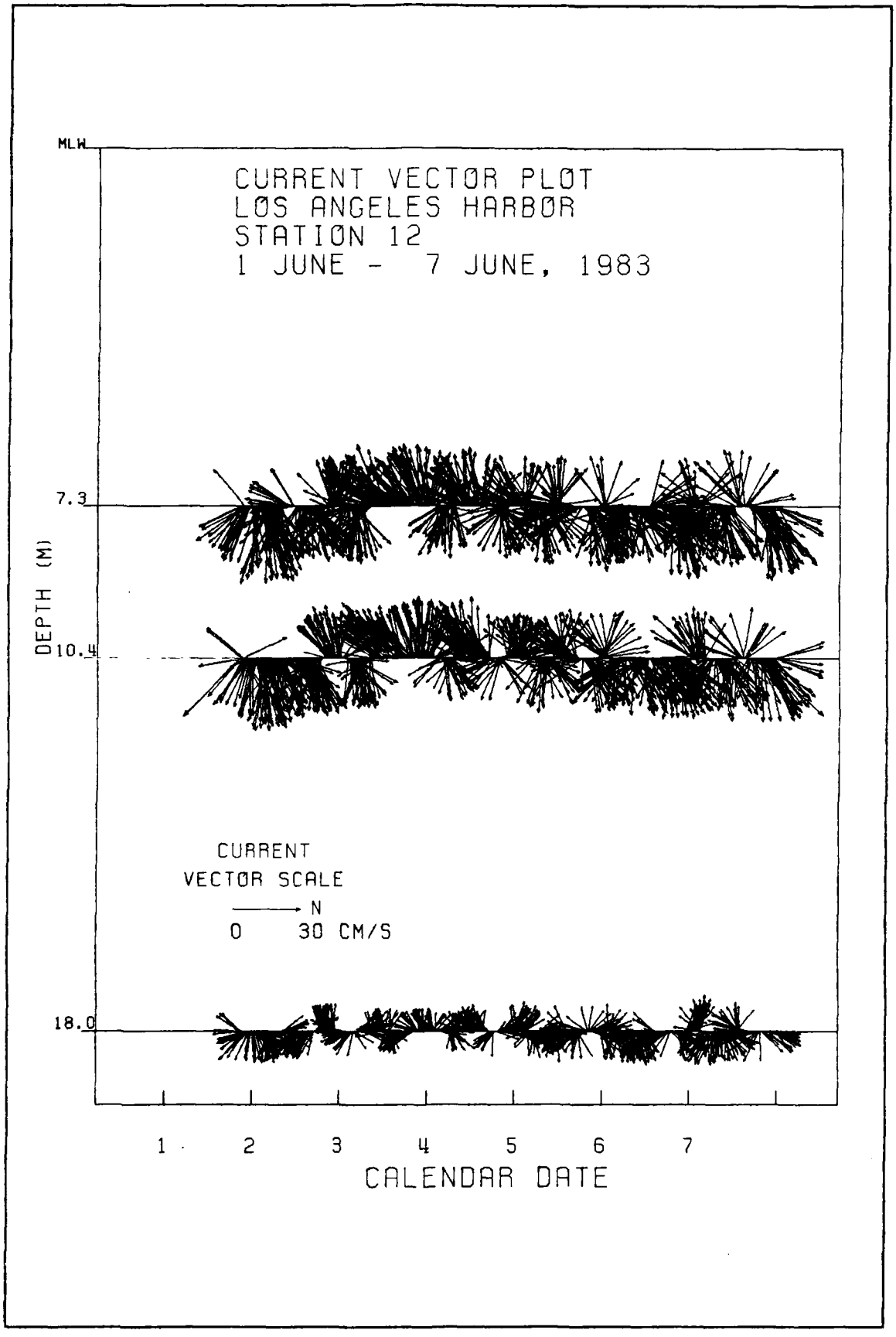
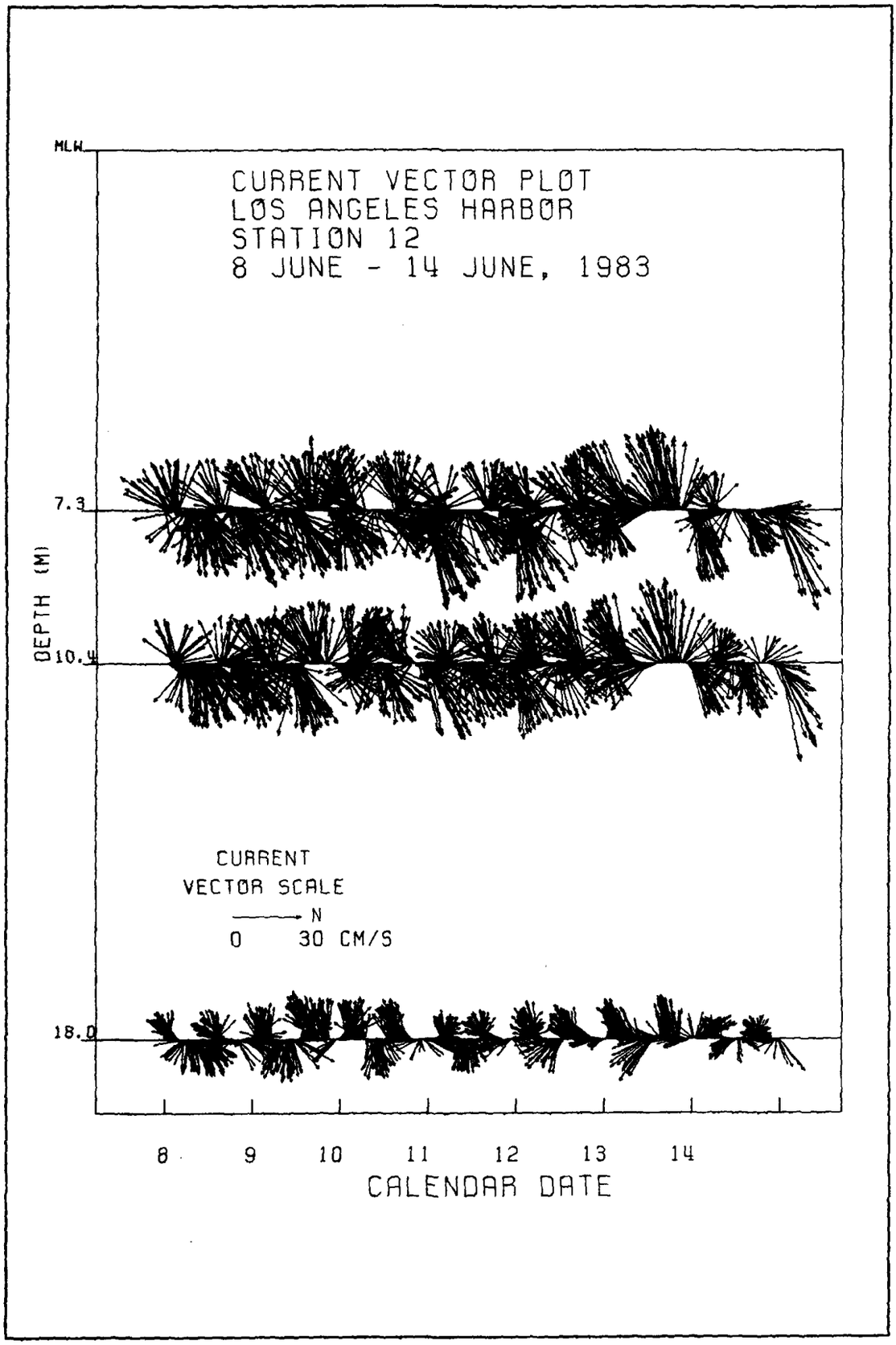
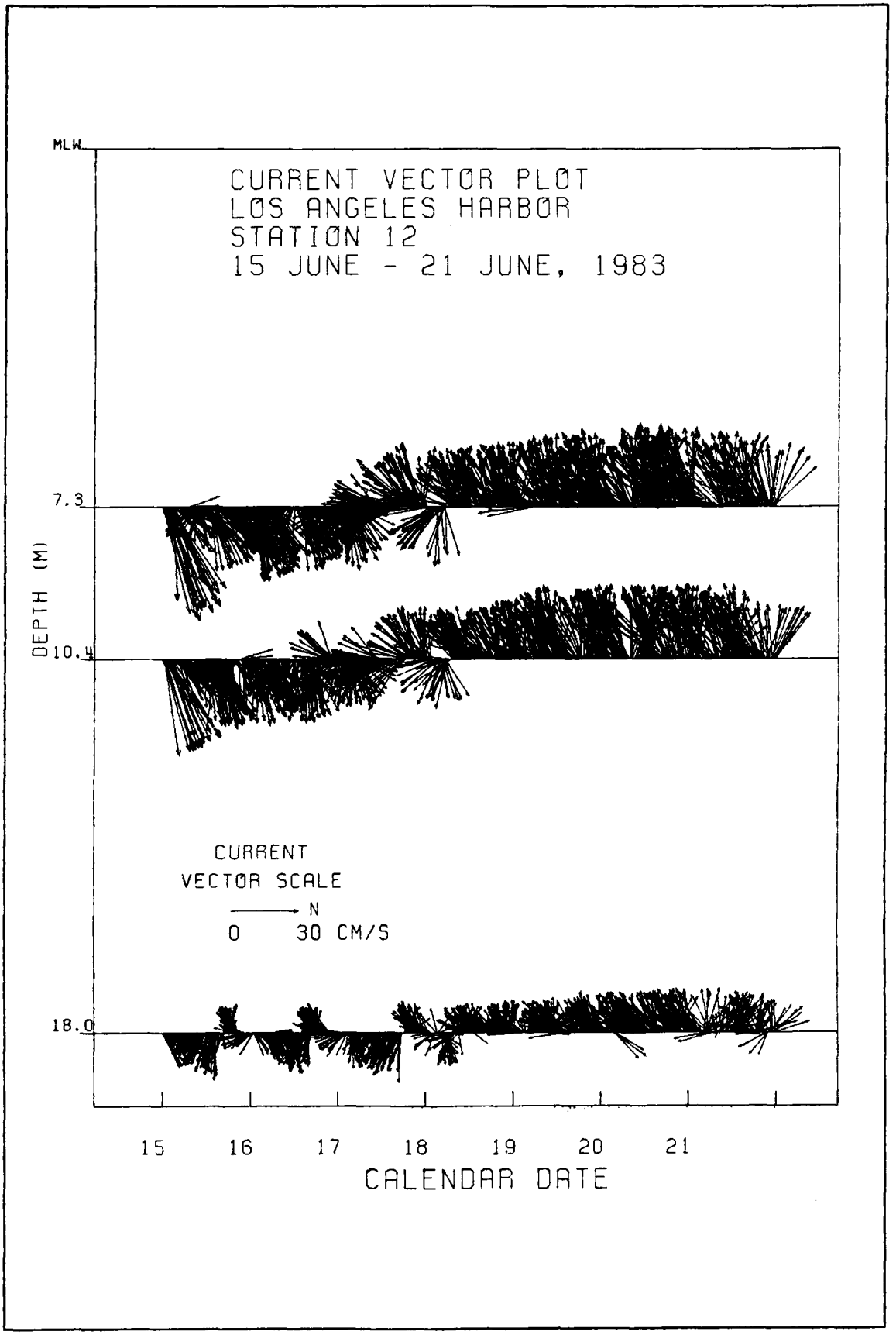
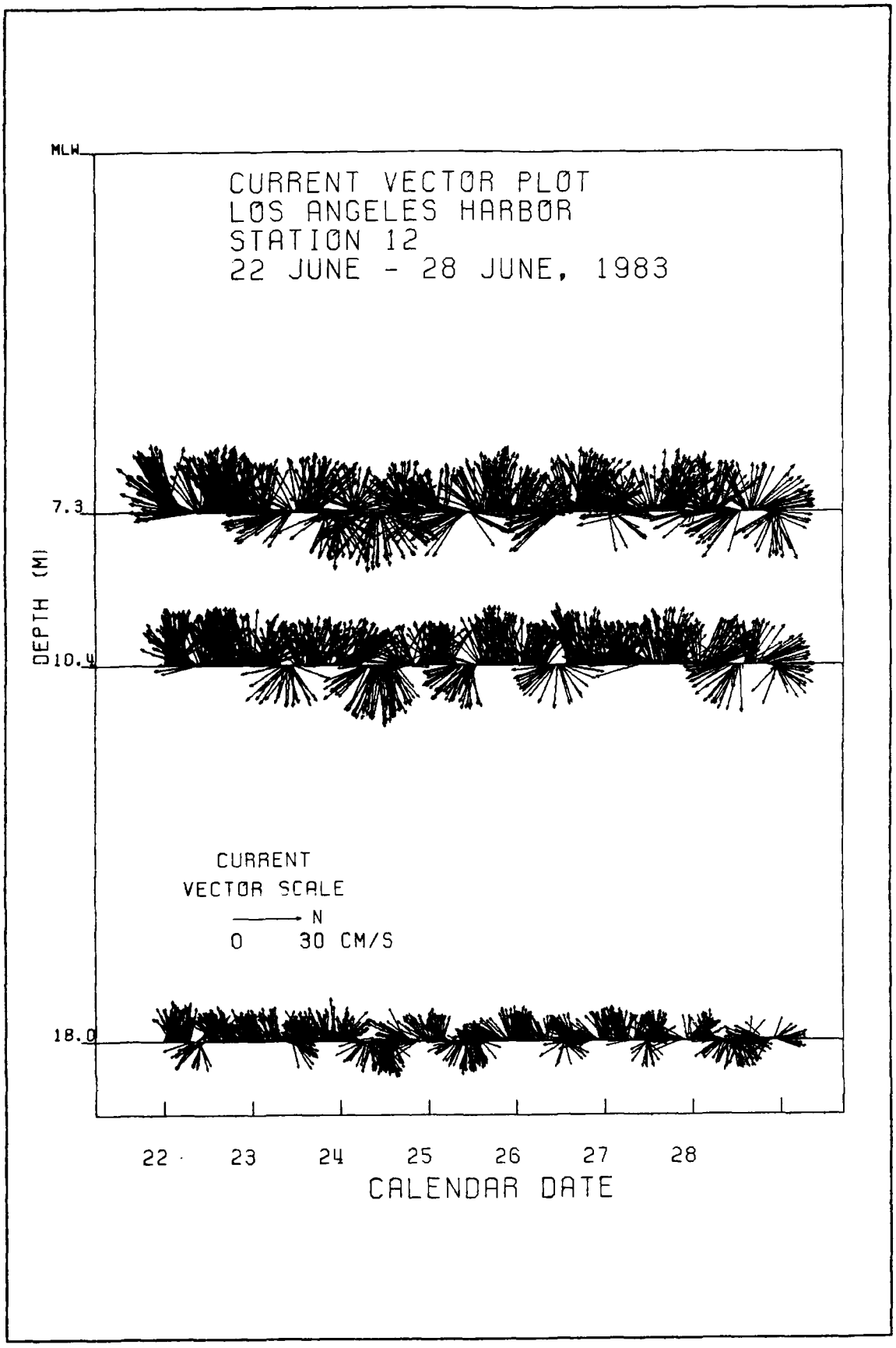
S
LOS ANGELES HARBOR
STATION 35, 4.9 M DEPTH
16 JUNE - 5 JULY, 1983

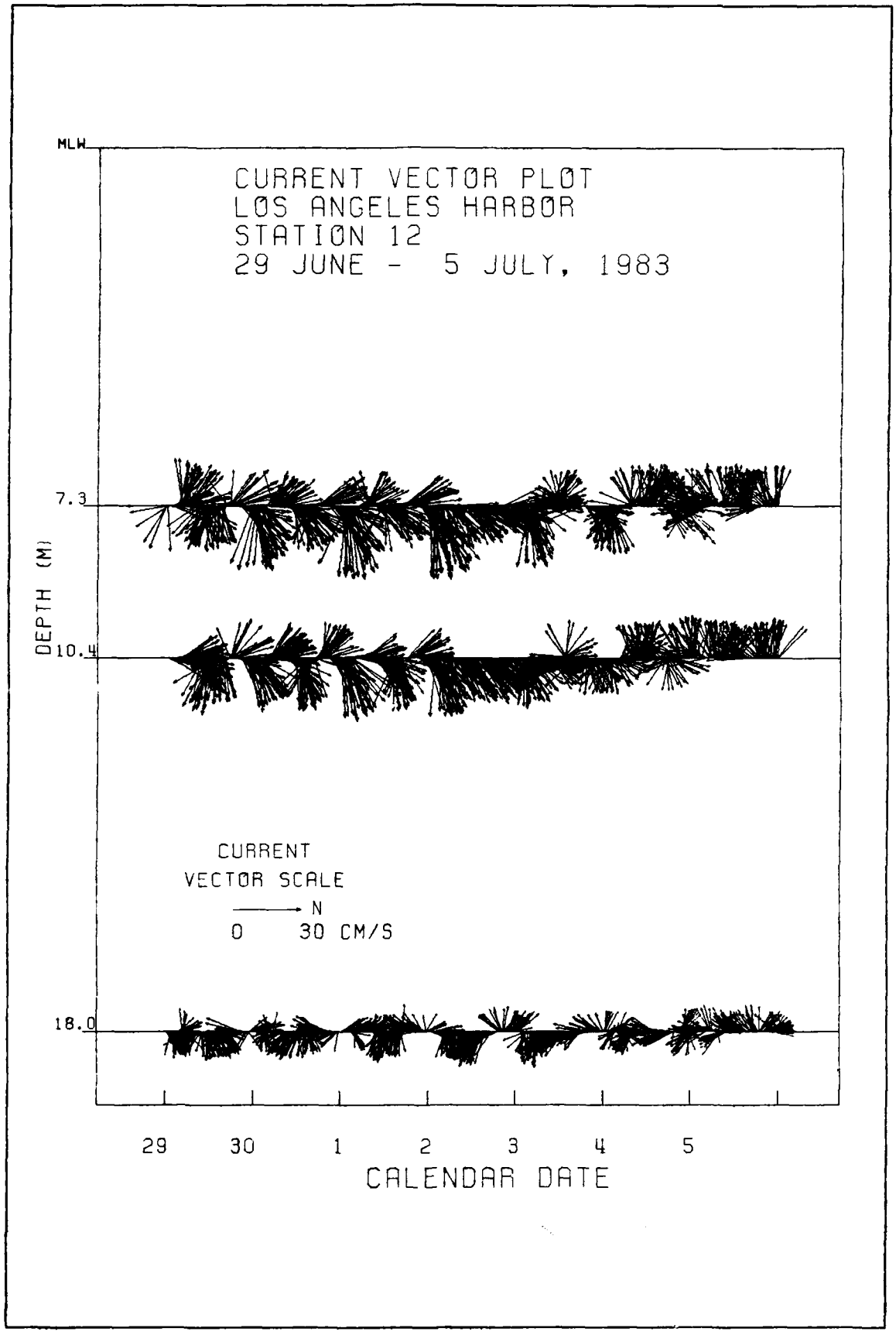
APPENDIX B: CURRENT VECTOR PLOTS

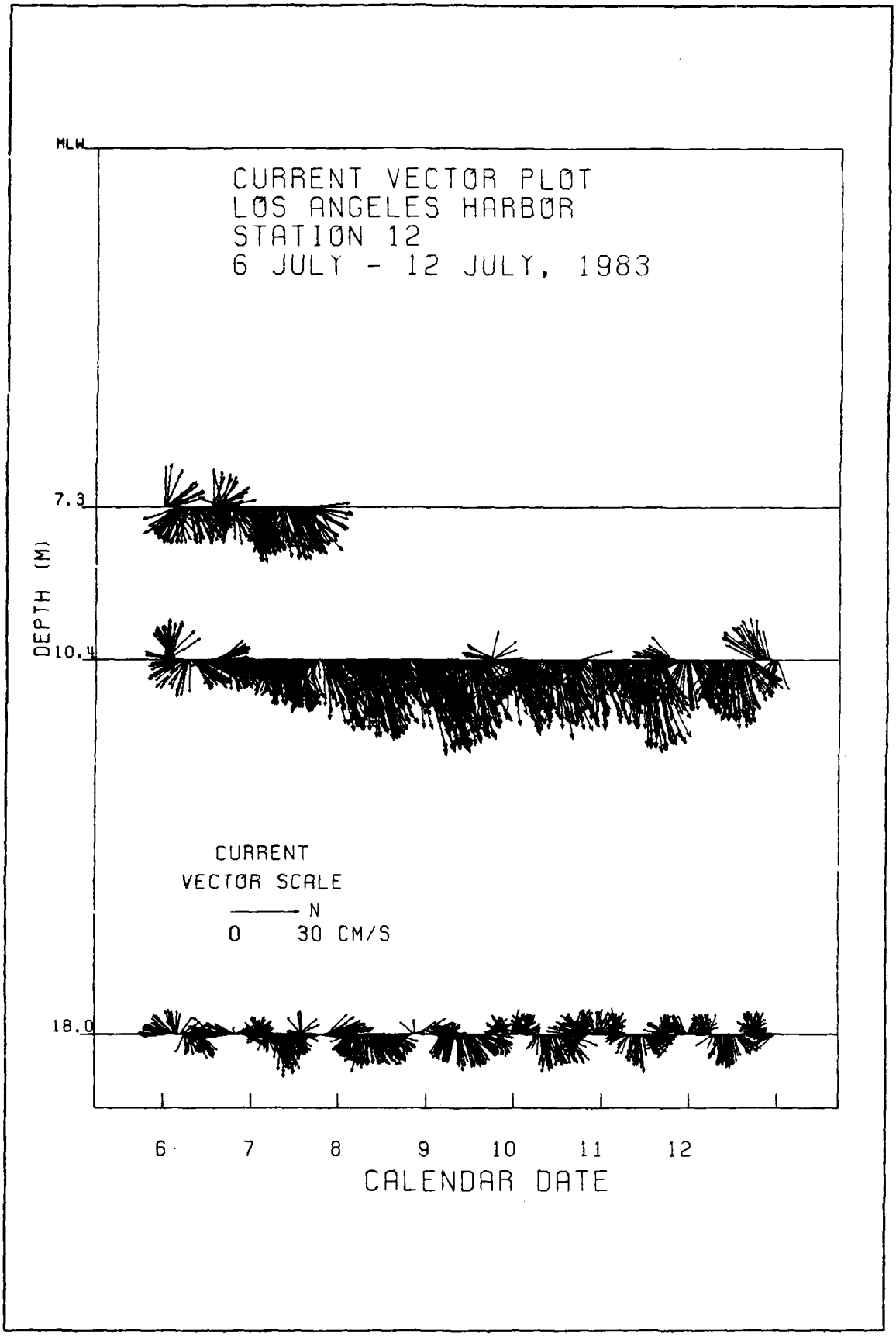

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 12
1 JUNE - 7 JUNE, 1983
7.3
10.4
18.0
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
1
2
3
4
5
6
7
CALENDAR DATE

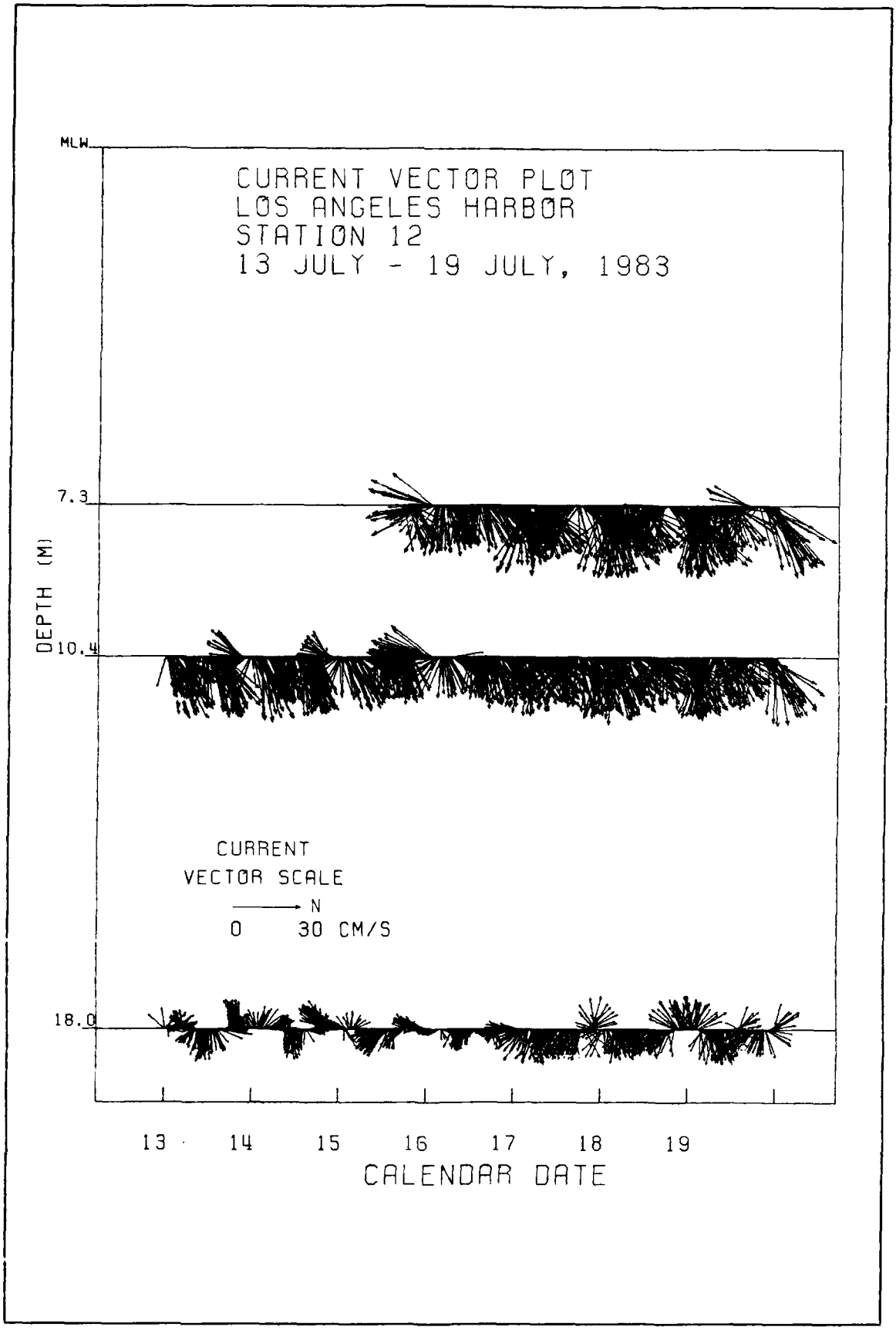

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 12
8 JUNE - 14 JUNE, 1983
7.3
10.4
18.0
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
8 9 10 11 12 13 14
CALENDAR DATE


MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 12
15 JUNE - 21 JUNE, 1983
7.3
10.4
18.0
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
15
16
17
18
19
20
21
CALENDAR DATE


MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 12
22 JUNE - 28 JUNE, 1983
7.3
10.4
18.0
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
22
23
24
25
26
27
28
CALENDAR DATE


MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 12
29 JUNE - 5 JULY, 1983
7.3
10.4
18.0
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
29 30 1 2 3 4 5
CALENDAR DATE


CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 12
6 JULY - 12 JULY, 1983
MLW
7.3
10.4
18.0
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
6 7 8 9 10 11 12
CALENDAR DATE


MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 12
13 JULY - 19 JULY, 1983
7.3
10.4
18.0
DEPTH (M)
CURRENT
VECTOR SCALE
N
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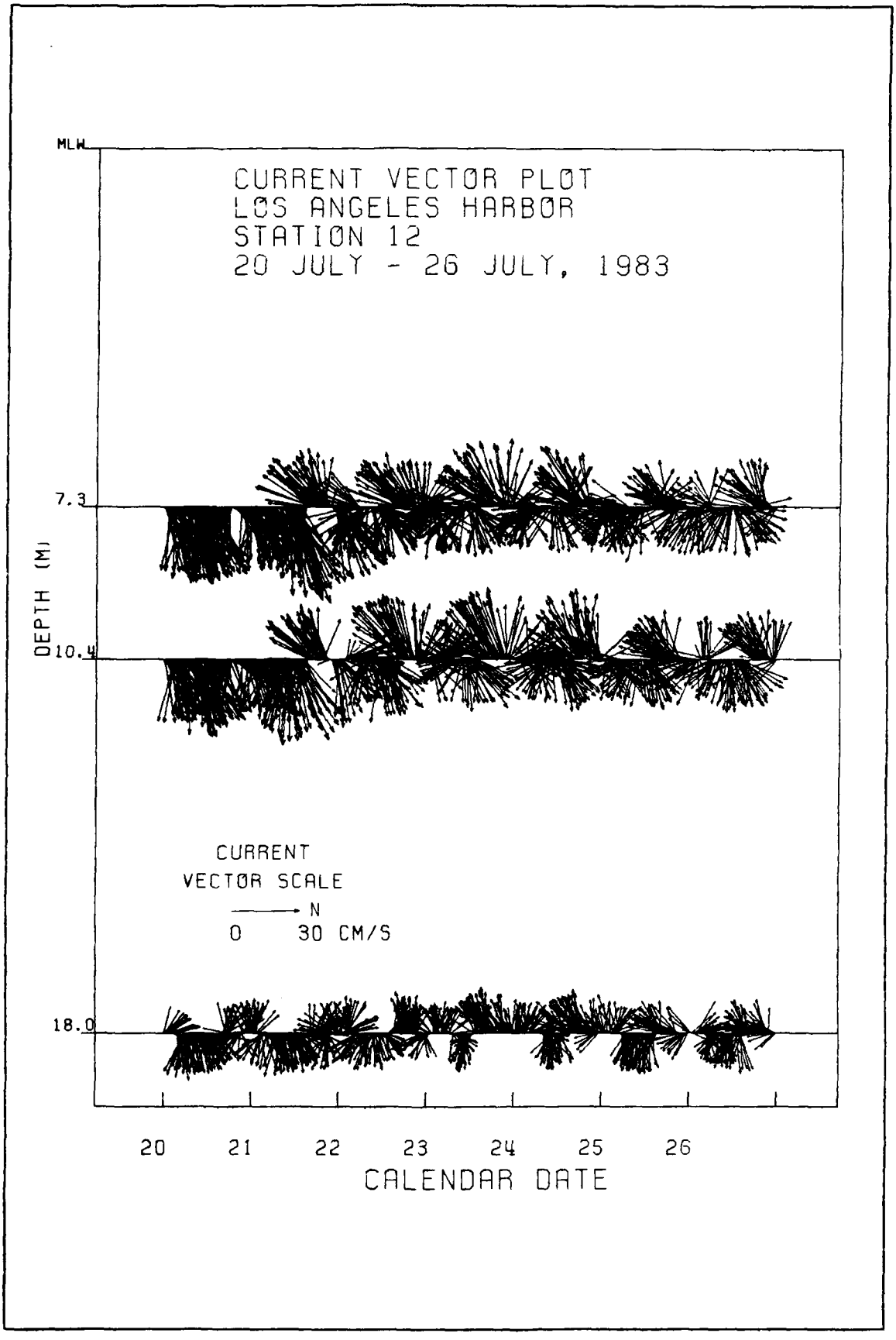
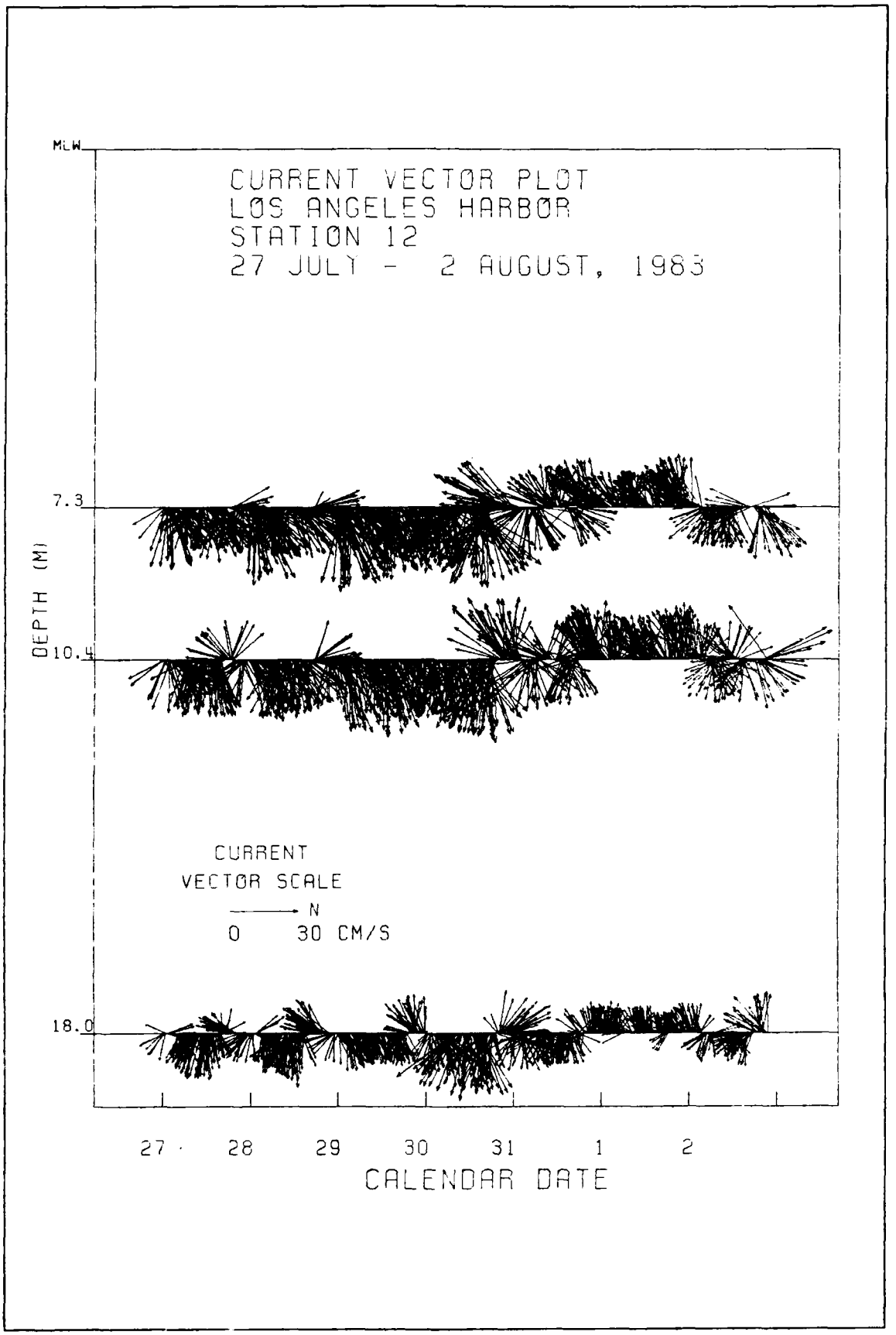
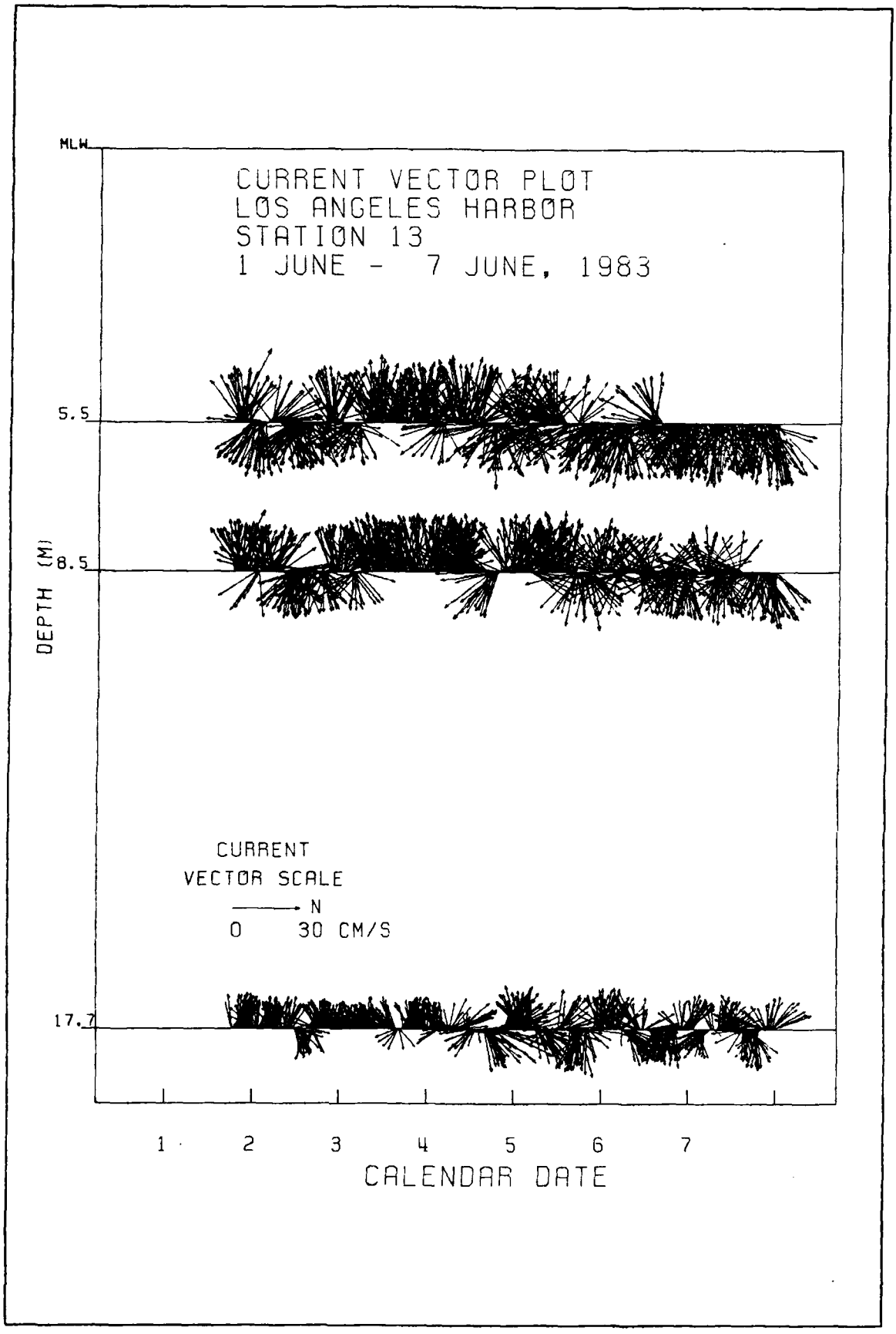
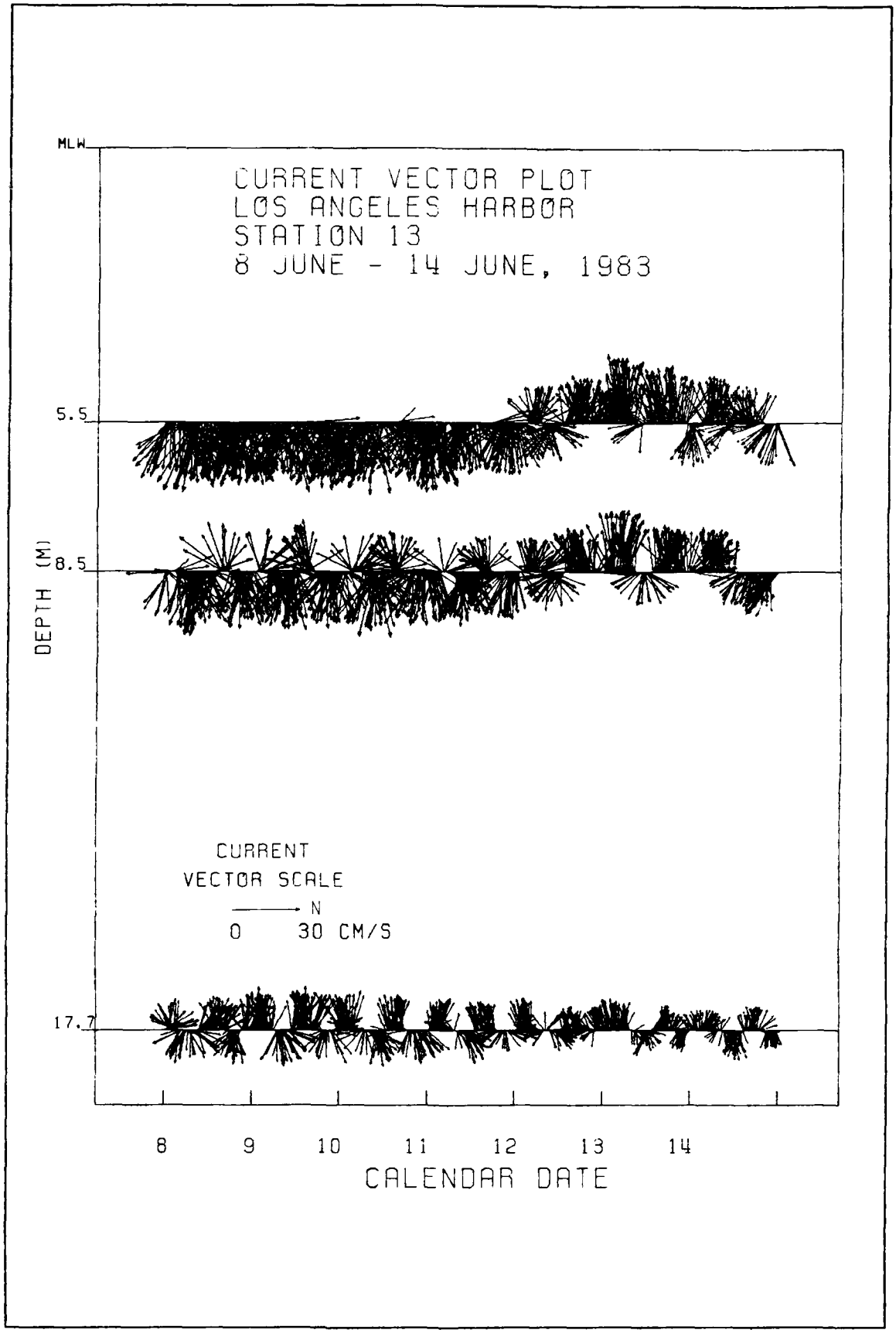
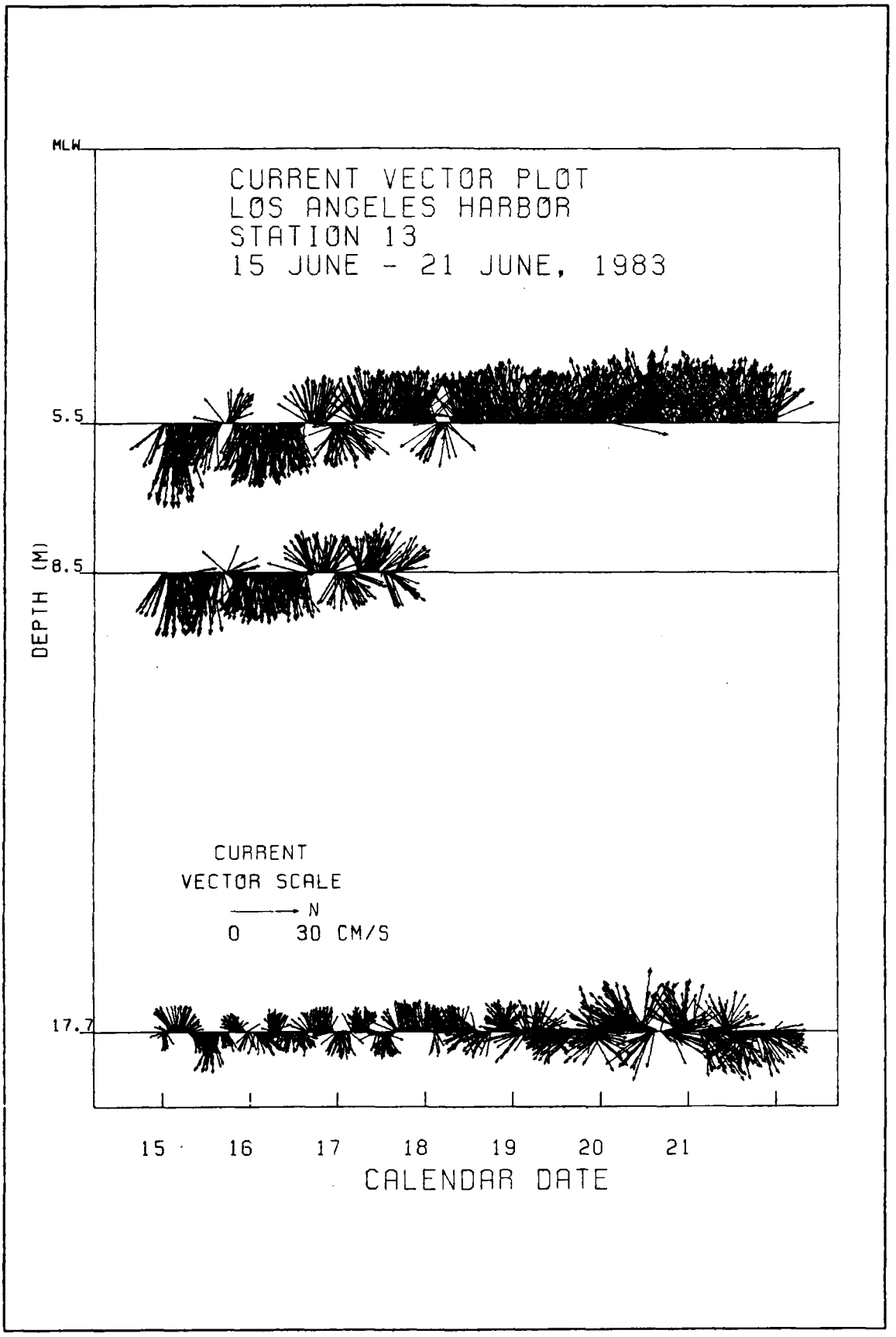
13 14 15 16 17 18 19
CALENDAR DATE

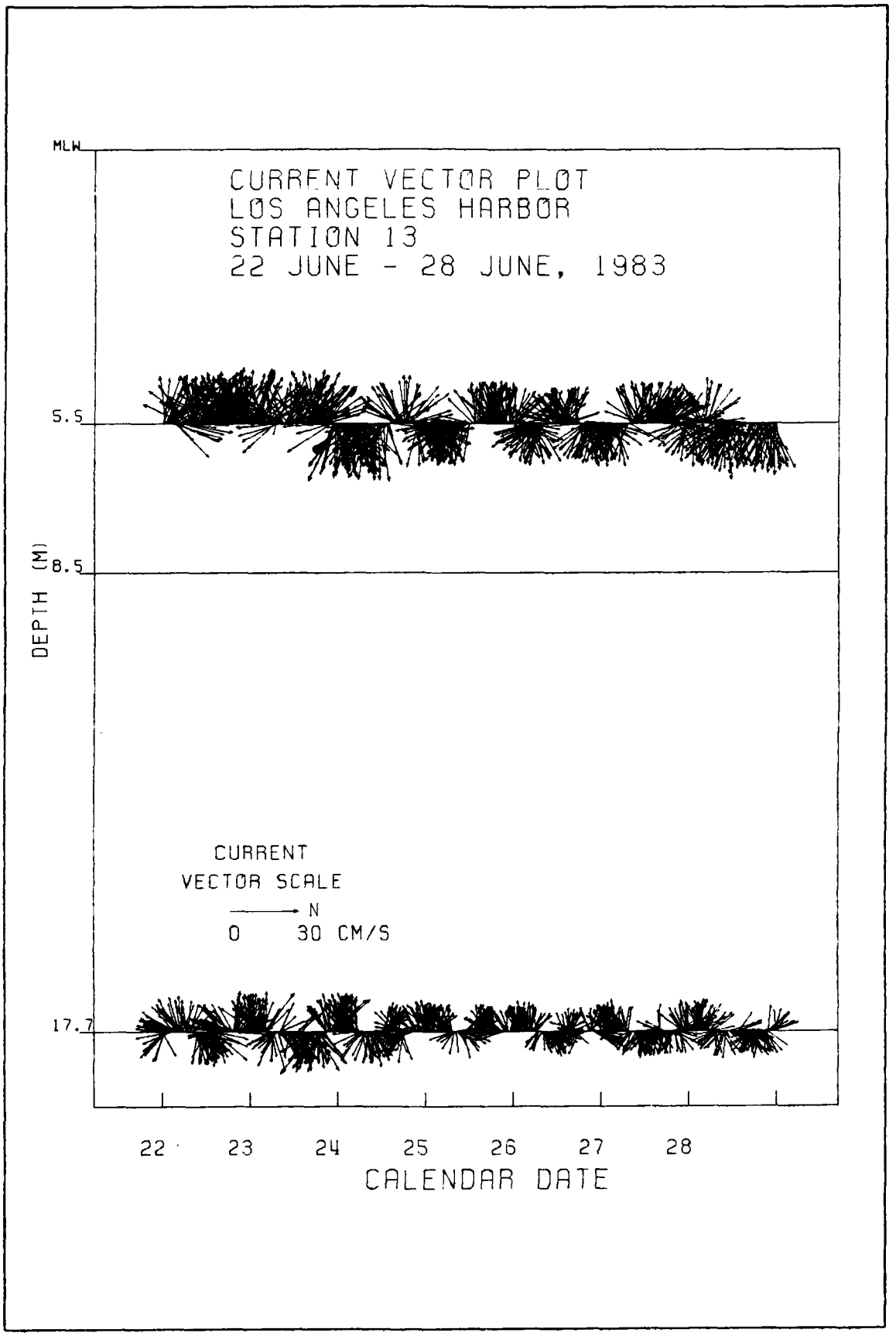

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 12
20 JULY - 26 JULY, 1983
MLW
7.3
10.4
18.0
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
20 21 22 23 24 25 26
CALENDAR DATE

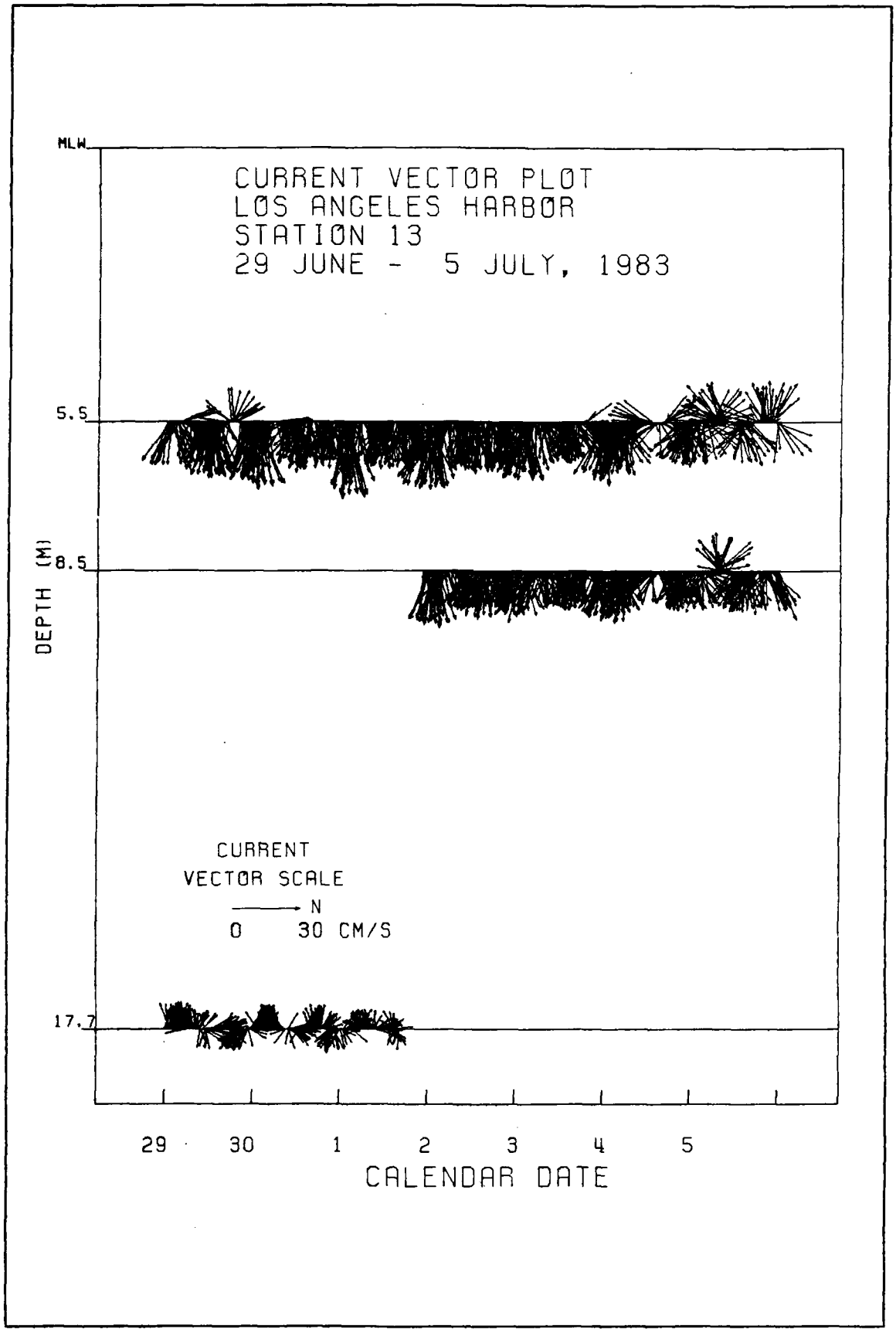

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 12
27 JULY - 2 AUGUST, 1983
7.3
10.4
18.0
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
27
28
29
30
31
1
2
CALENDAR DATE

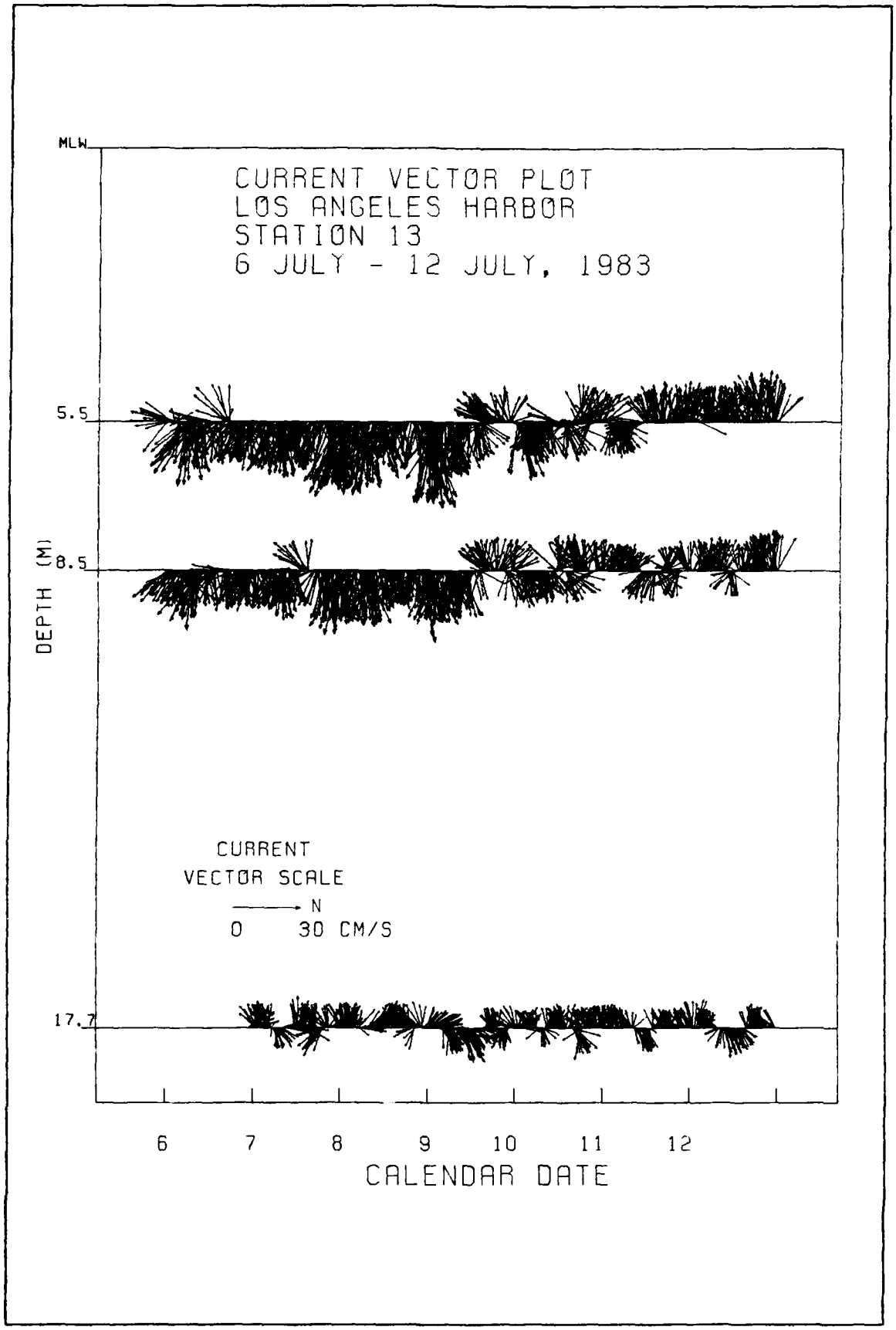

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 13
1 JUNE - 7 JUNE, 1983
MLW
5.5
8.5
17.7
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
1
2
3
4
5
6
7
CALENDAR DATE

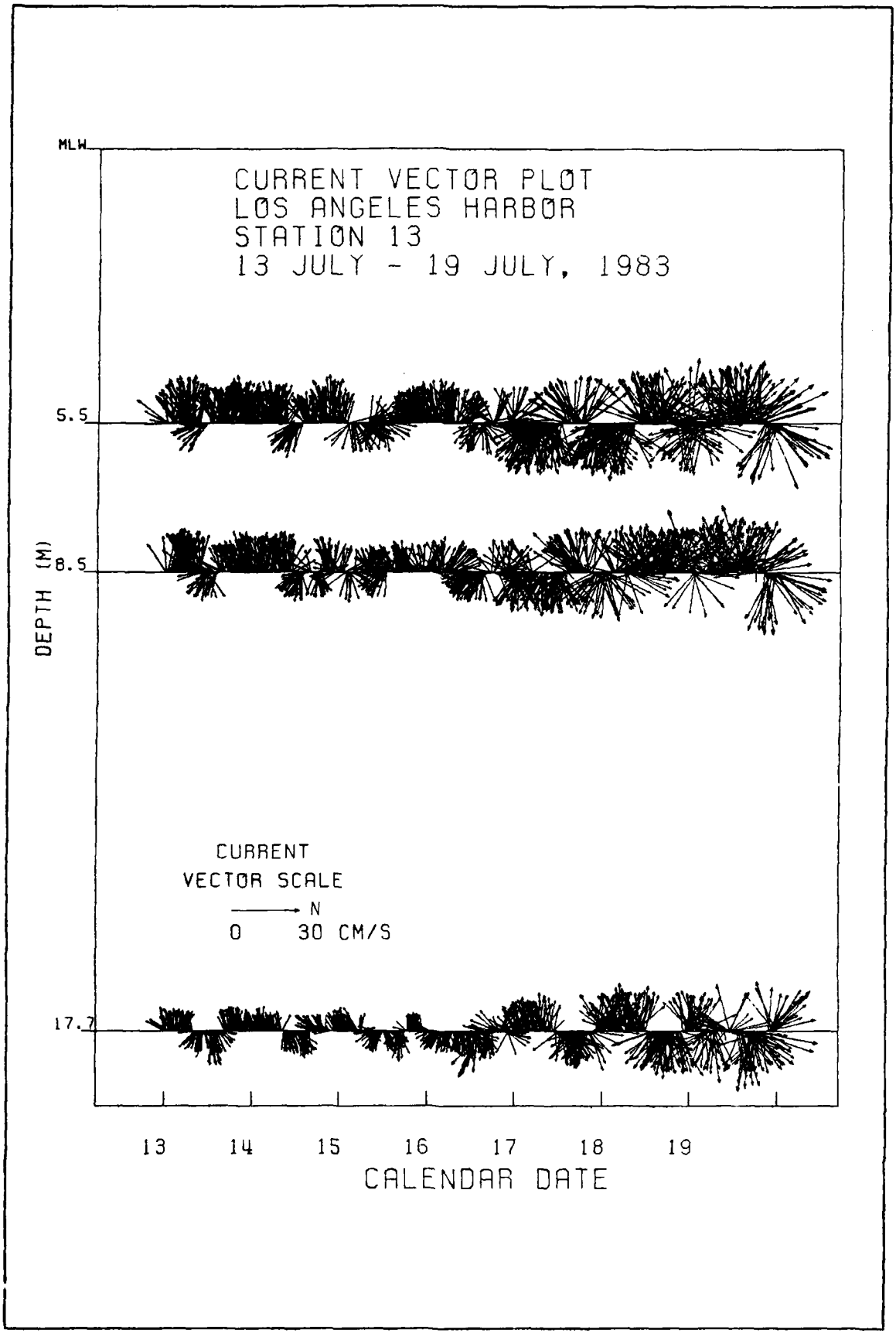

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 13
8 JUNE - 14 JUNE, 1983
MLW
5.5
8.5
17.7
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
8 9 10 11 12 13 14
CALENDAR DATE

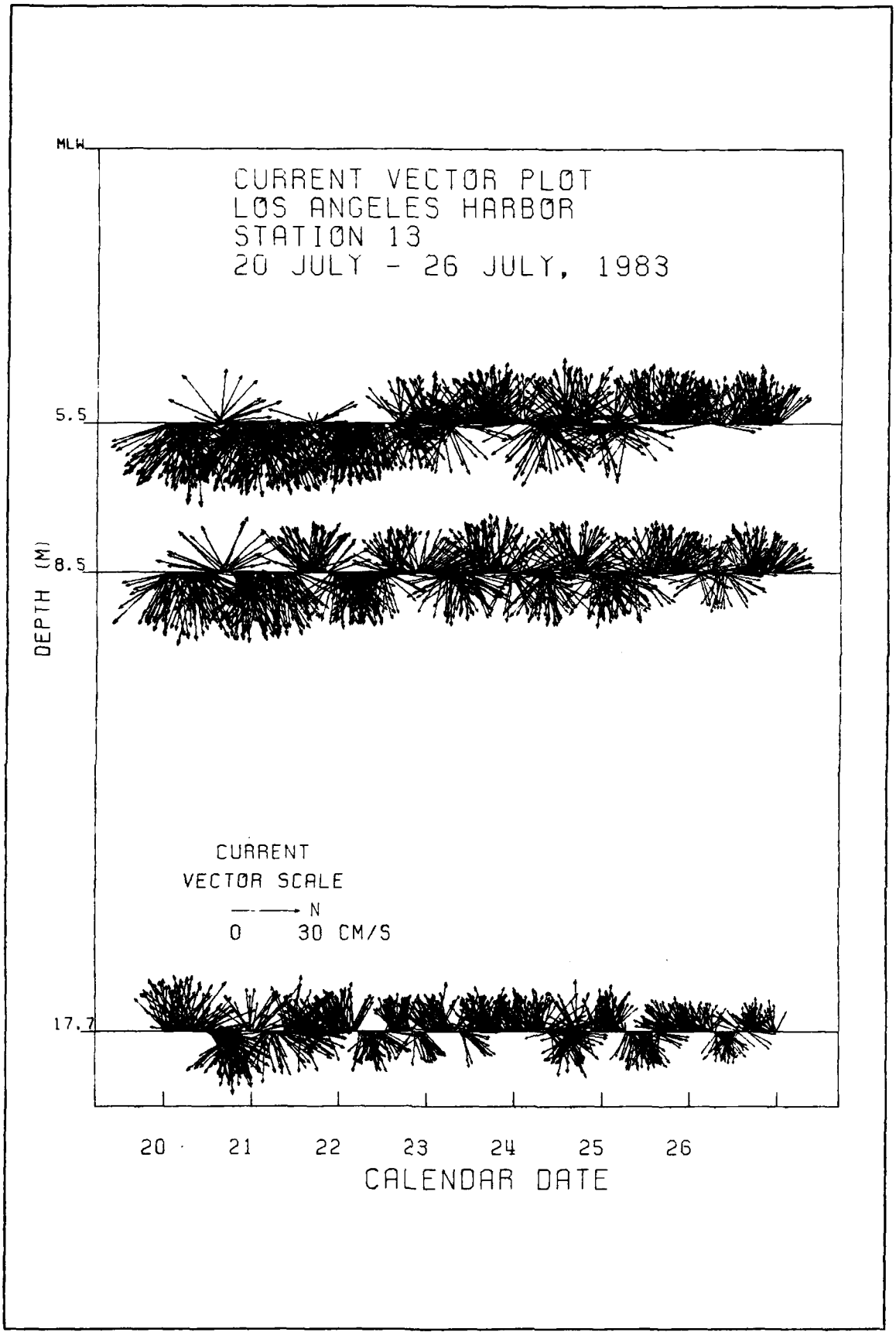

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 13
15 JUNE - 21 JUNE, 1983
MLW
5.5
8.5
17.7
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
15
16
17
18
19
20
21
CALENDAR DATE

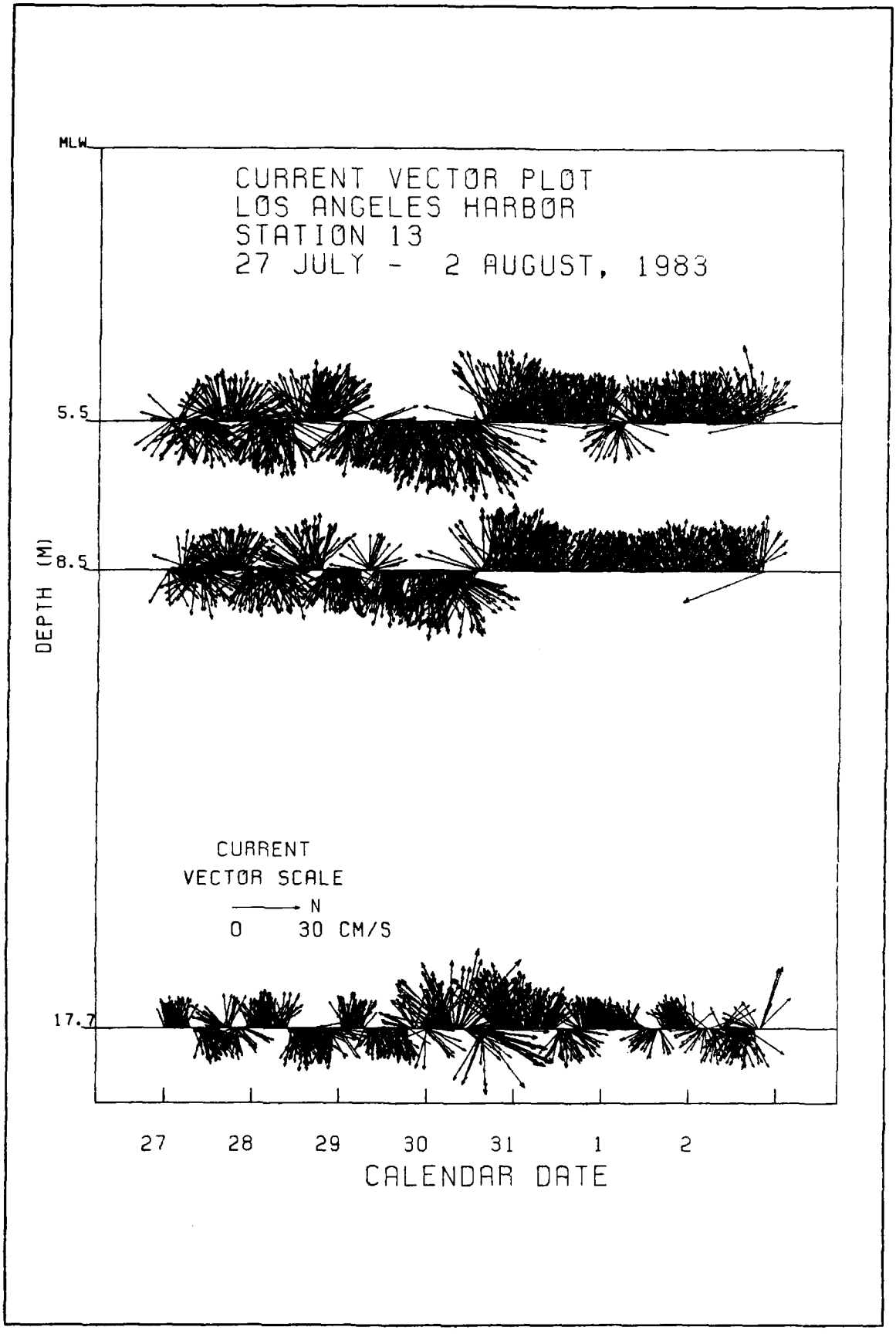

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 13
22 JUNE - 28 JUNE, 1983
MLW
5.5
8.5
17.7
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
22
23
24
25
26
27
28
CALENDAR DATE

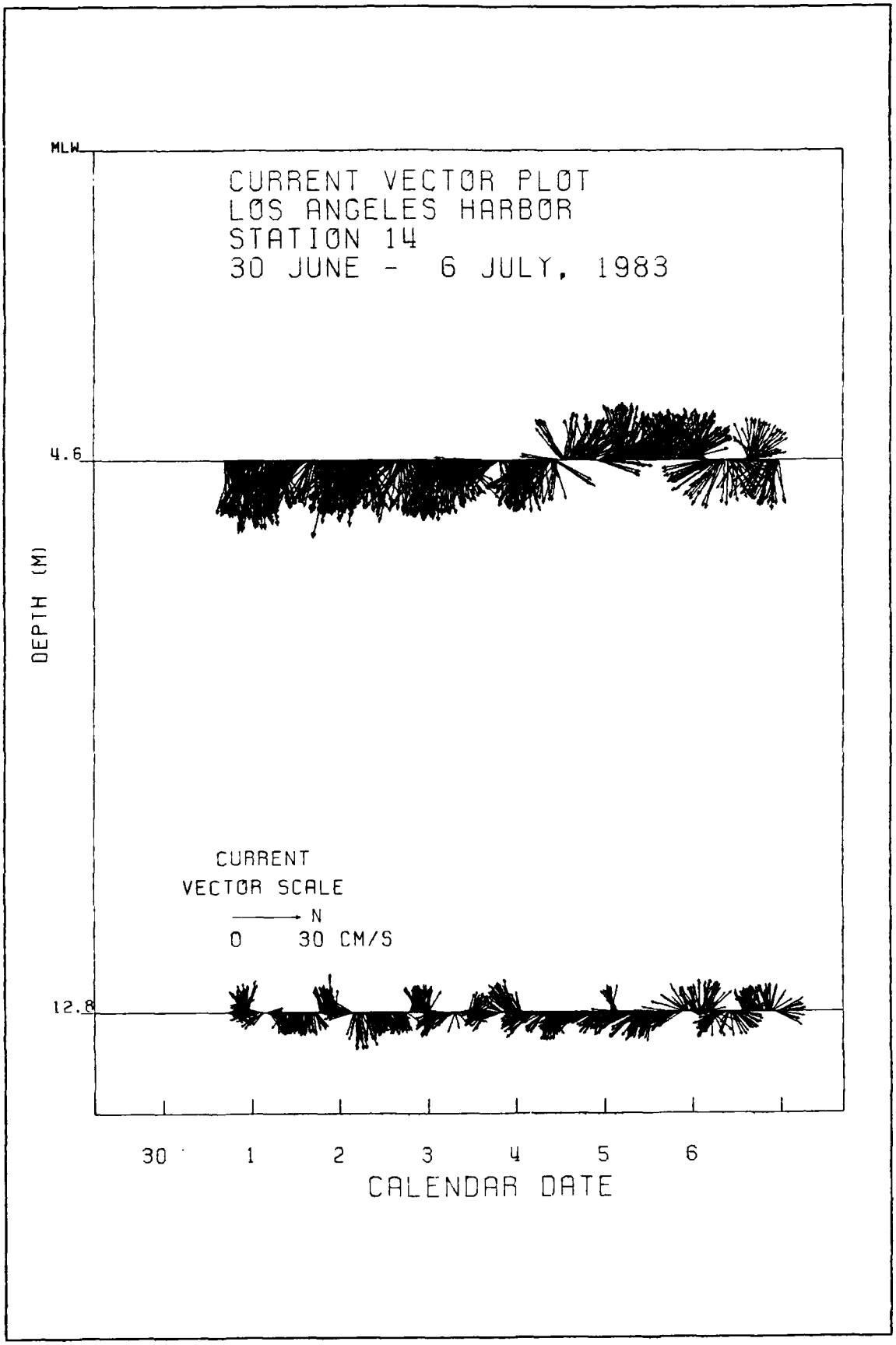

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 13
29 JUNE - 5 JULY, 1983
MLW
5.5
8.5
17.7
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
29 30 1 2 3 4 5
CALENDAR DATE

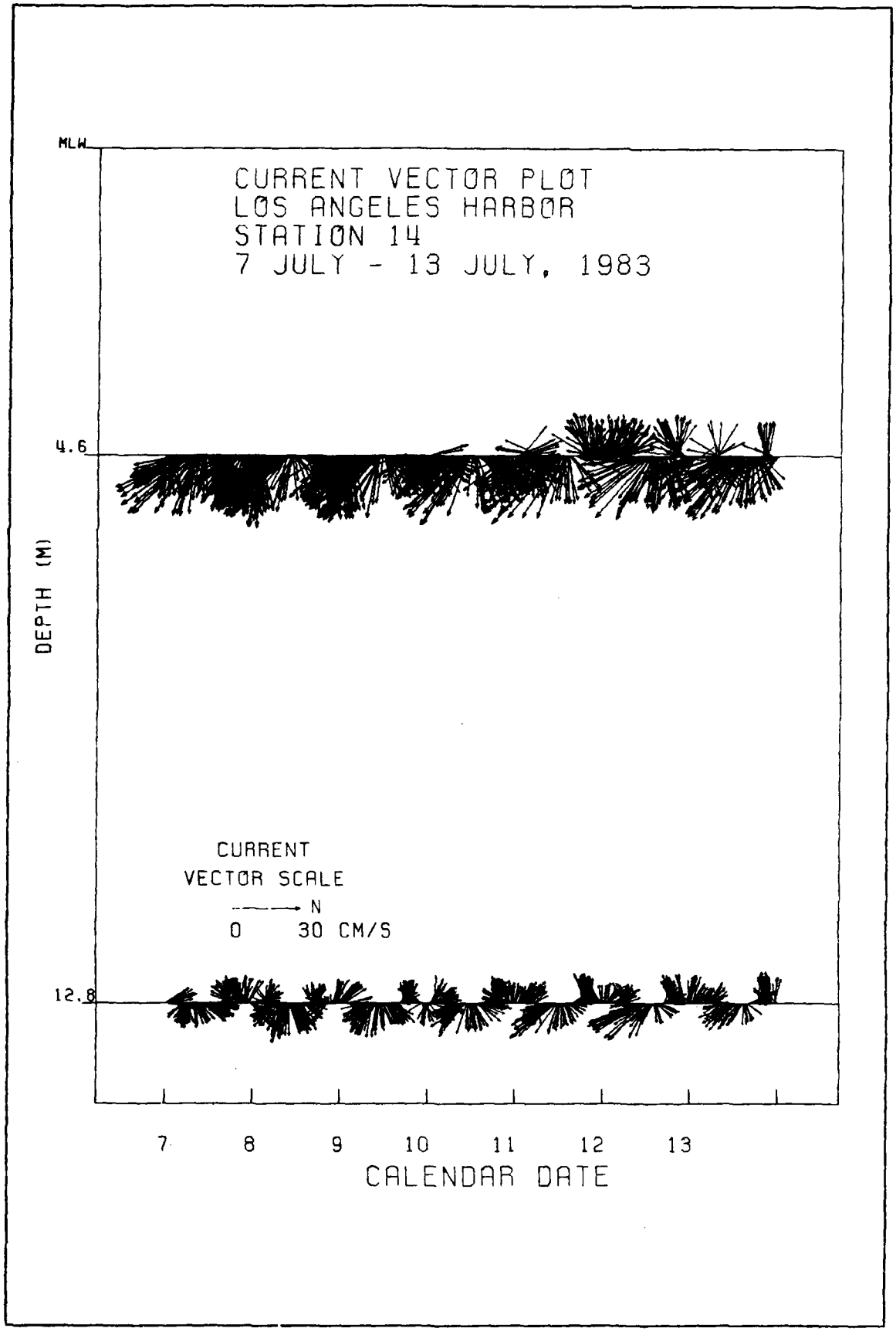

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 13
6 JULY - 12 JULY, 1983
MLW
5.5
8.5
17.7
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
6
7
8
9
10
11
12
CALENDAR DATE


CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 13
13 JULY - 19 JULY, 1983
MLW
5.5
8.5
17.7
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
13
14
15
16
17
18
19
CALENDAR DATE


CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 13
20 JULY - 26 JULY, 1983
MLW
5.5
8.5
17.7
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
20
21
22
23
24
25
26
CALENDAR DATE


CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 13
27 JULY - 2 AUGUST, 1983
MLW
5.5
8.5
17.7
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
27 28 29 30 31 1 2
CALENDAR DATE


CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 14
30 JUNE - 6 JULY, 1983
MLW
4.6
12.8
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
30 1 2 3 4 5 6
CALENDAR DATE


MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 14
7 JULY - 13 JULY, 1983
4.6
DEPTH (M)
CURRENT
VECTOR SCALE
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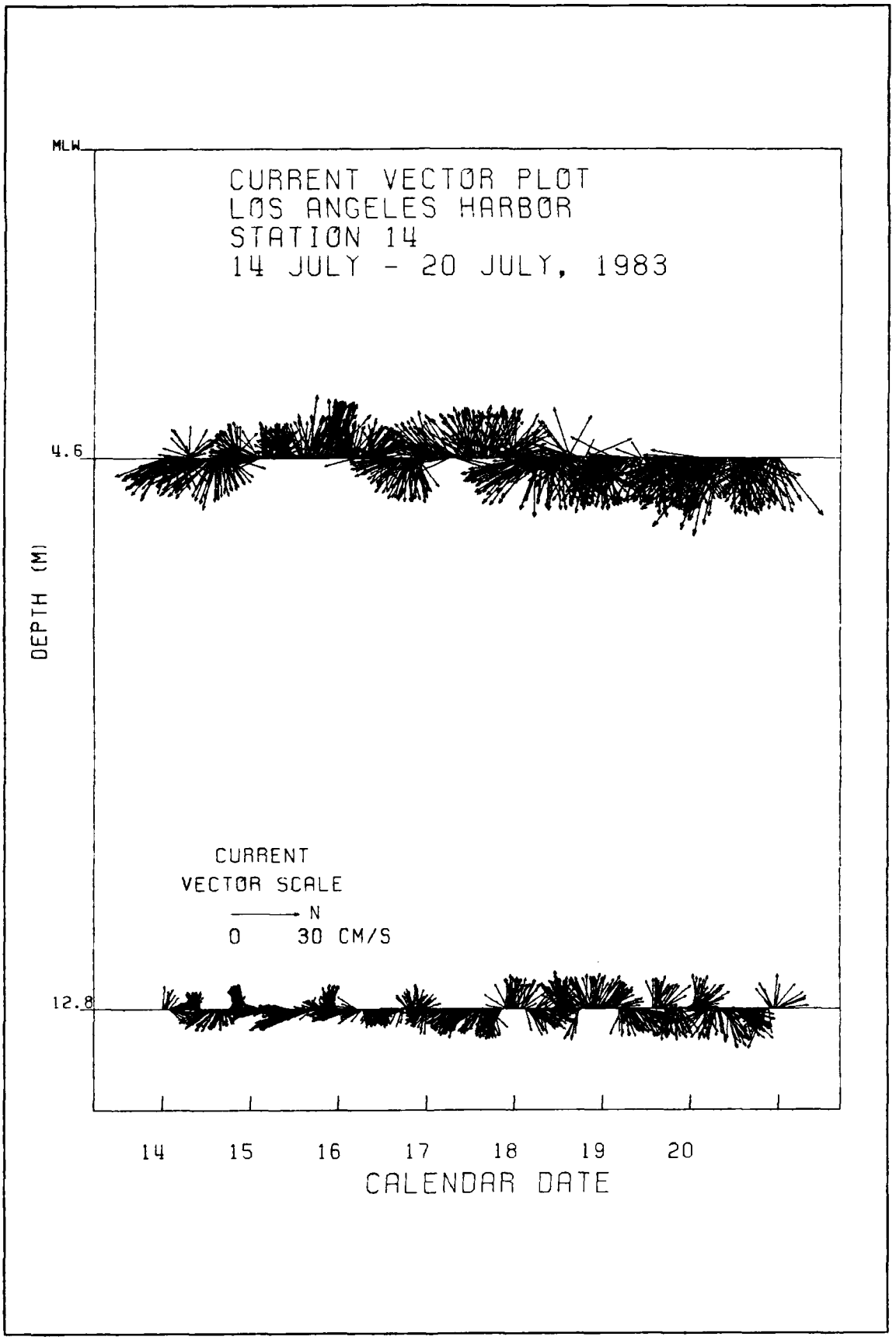
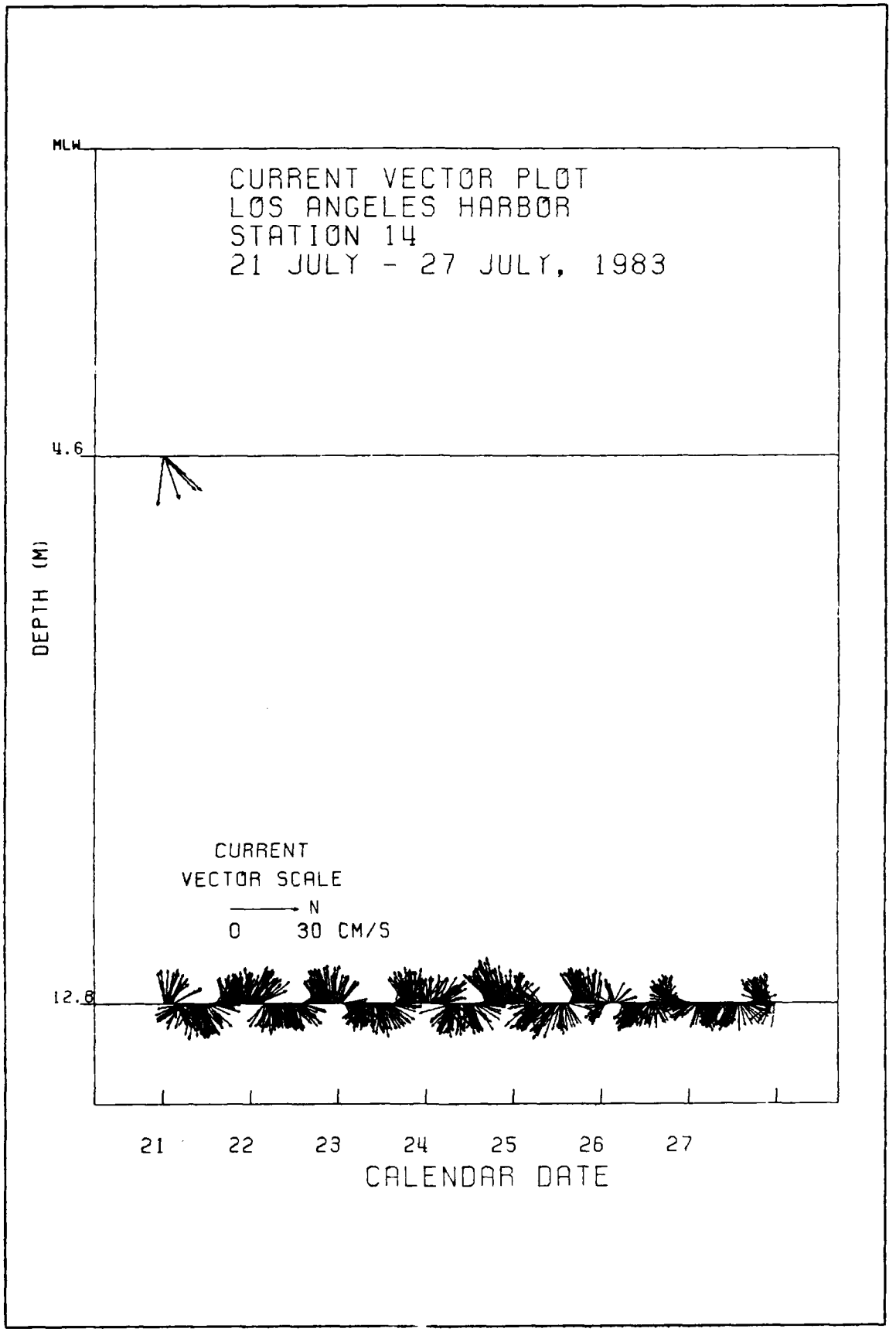
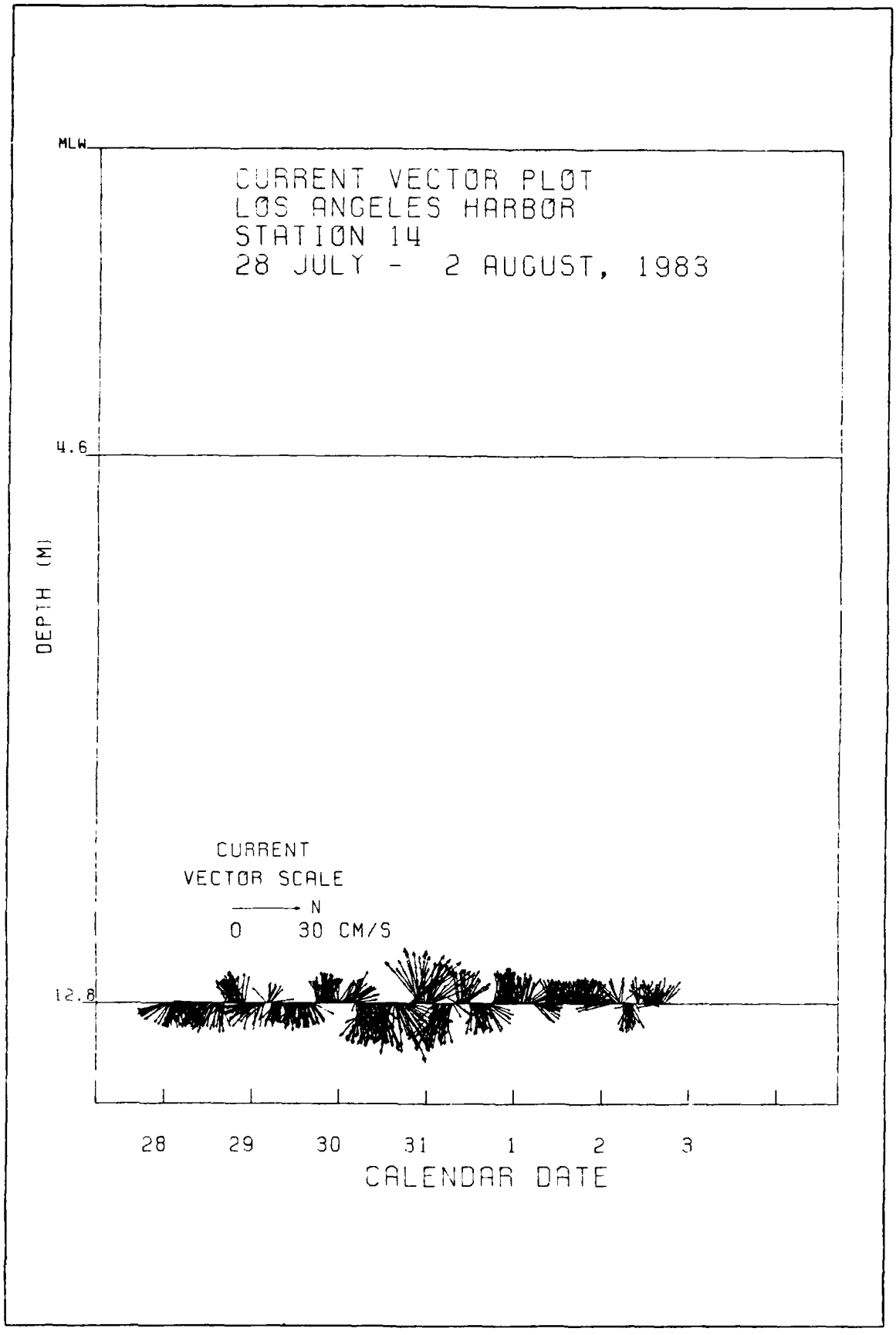
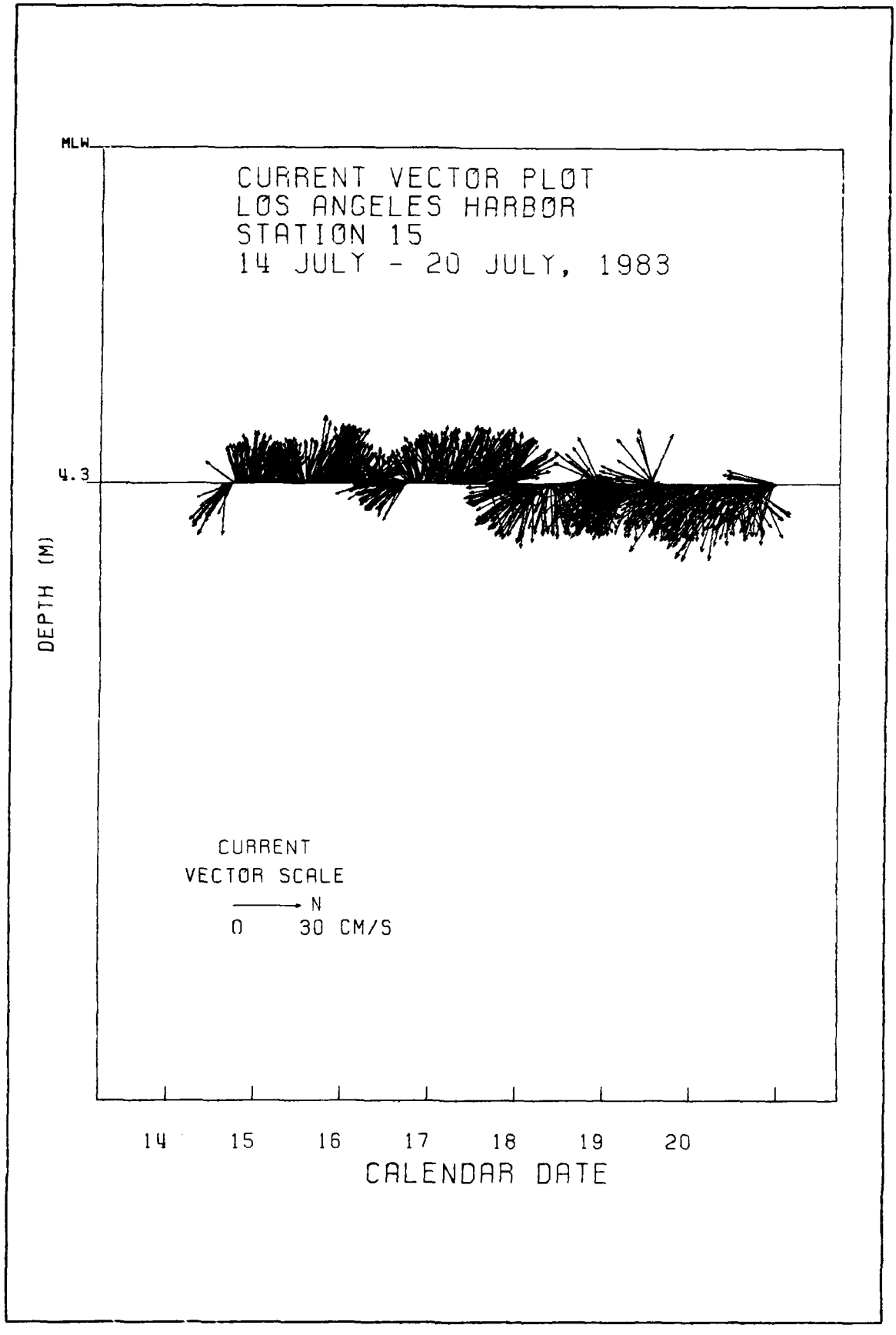
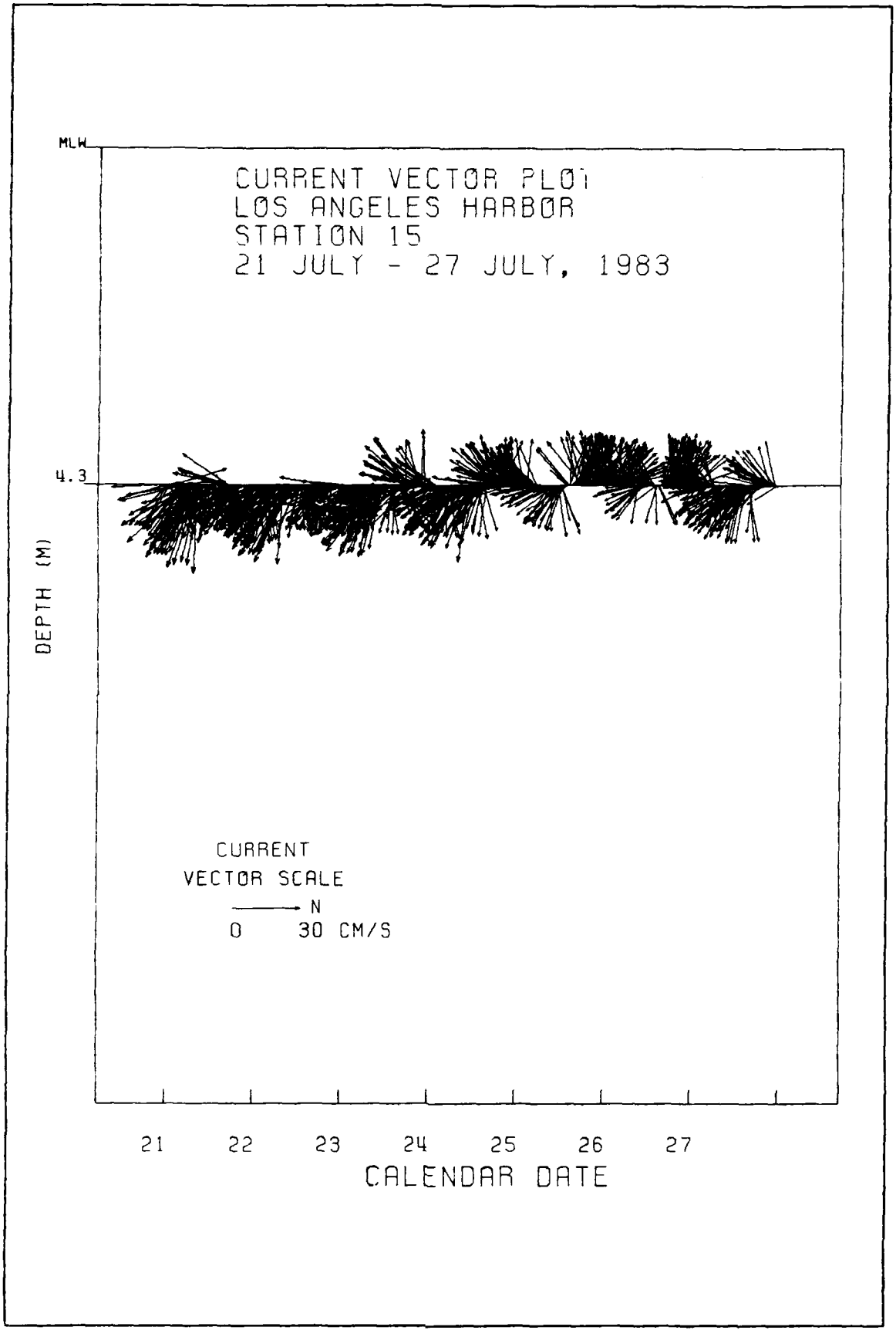
0 30 CM/S
12.8
7 8 9 10 11 12 13
CALENDAR DATE

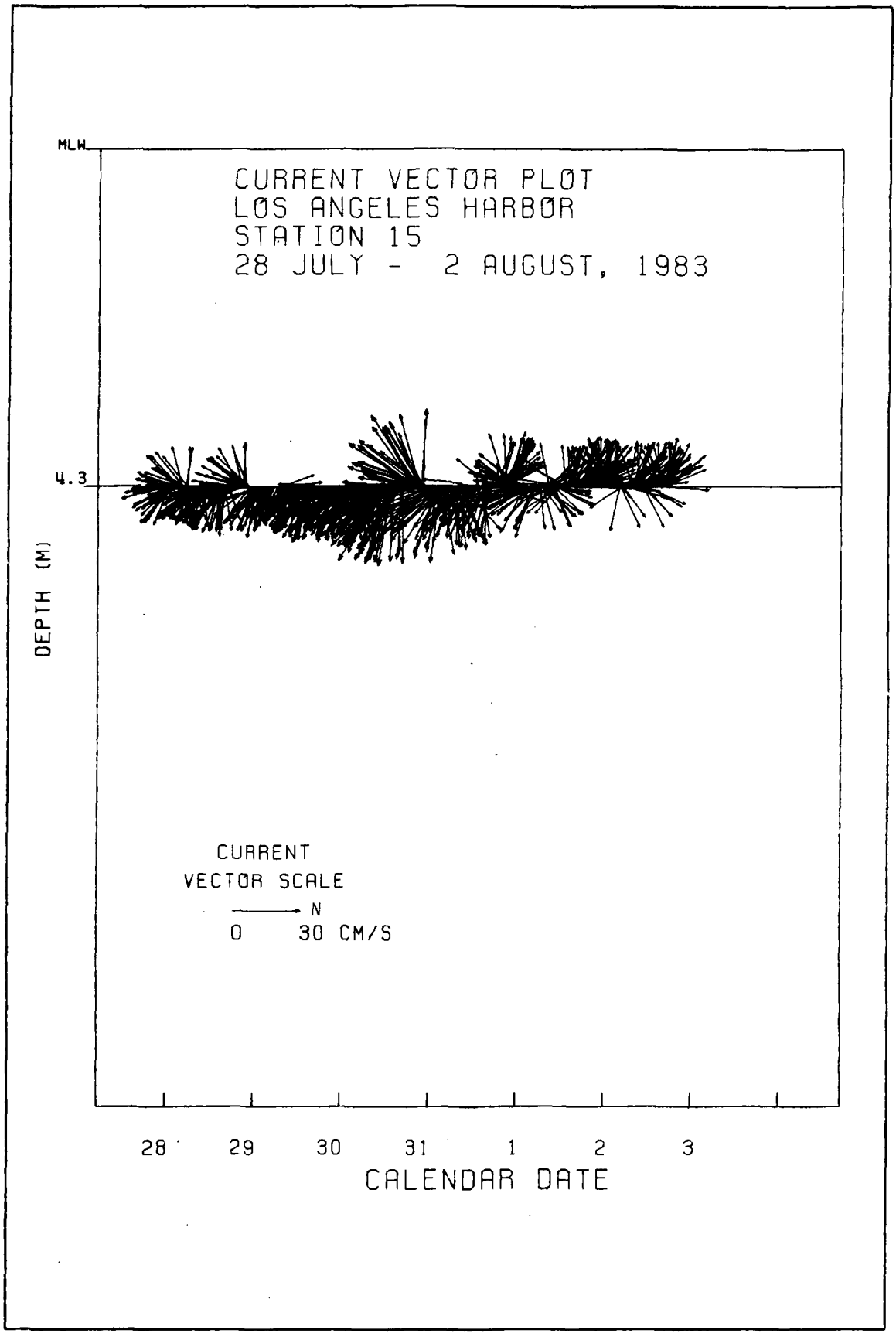

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 14
14 JULY - 20 JULY, 1983
4.6
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
12.8
14 15 16 17 18 19 20
CALENDAR DATE

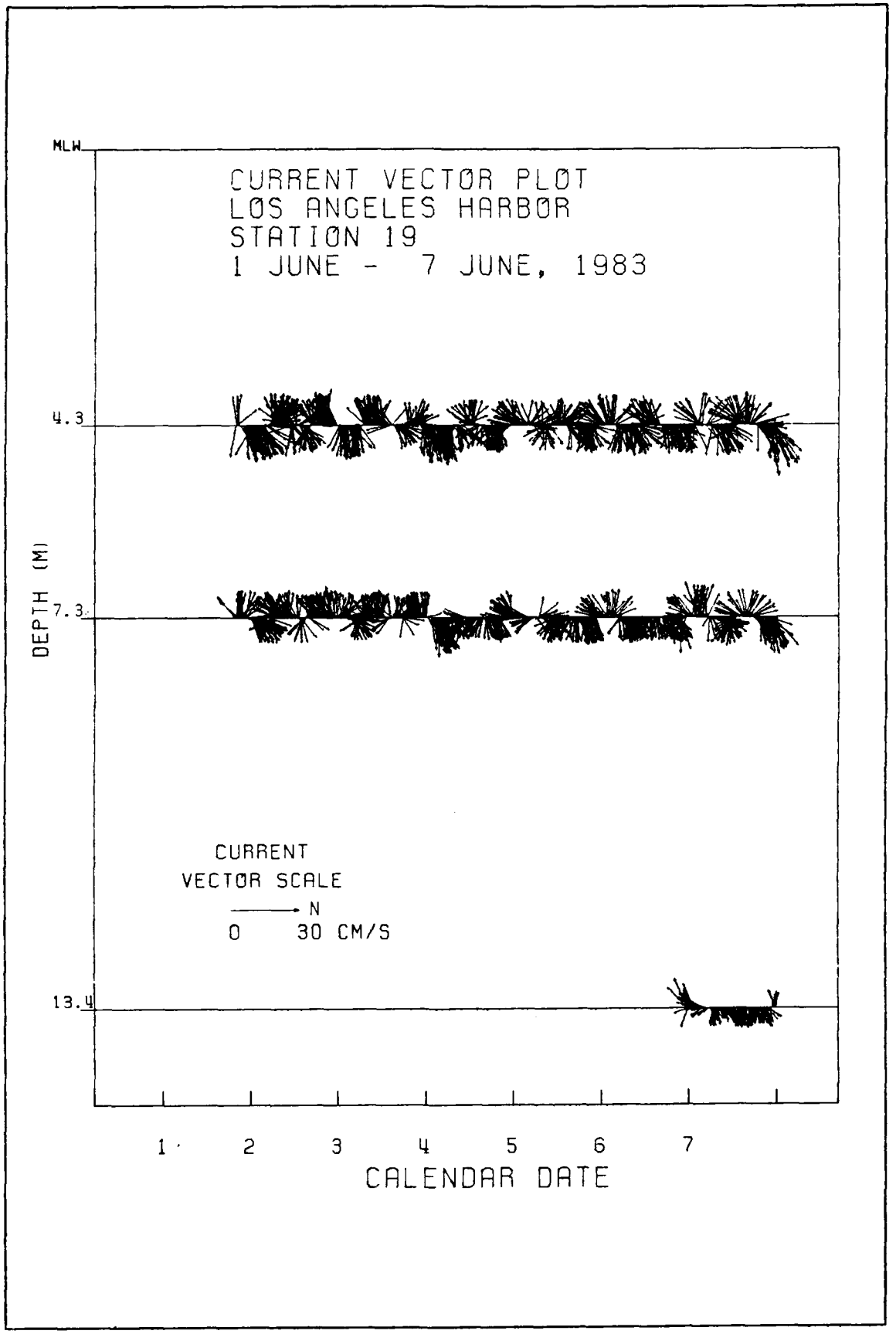

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 14
21 JULY - 27 JULY, 1983
MLW
4.6
12.8
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
21 22 23 24 25 26 27
CALENDAR DATE

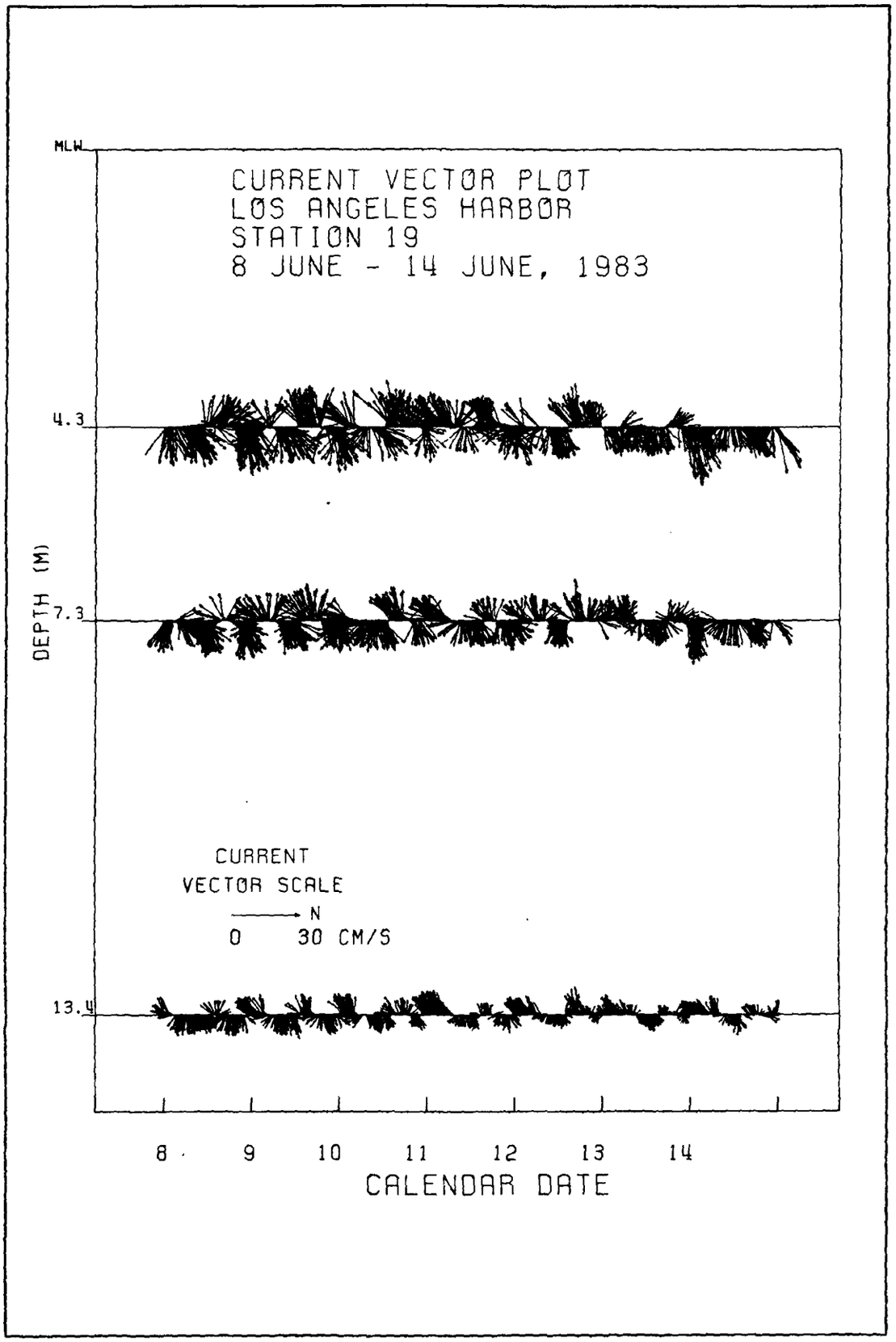

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 14
28 JULY - 2 AUGUST, 1983
MLW
4.6
12.8
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
28 29 30 31 1 2 3
CALENDAR DATE

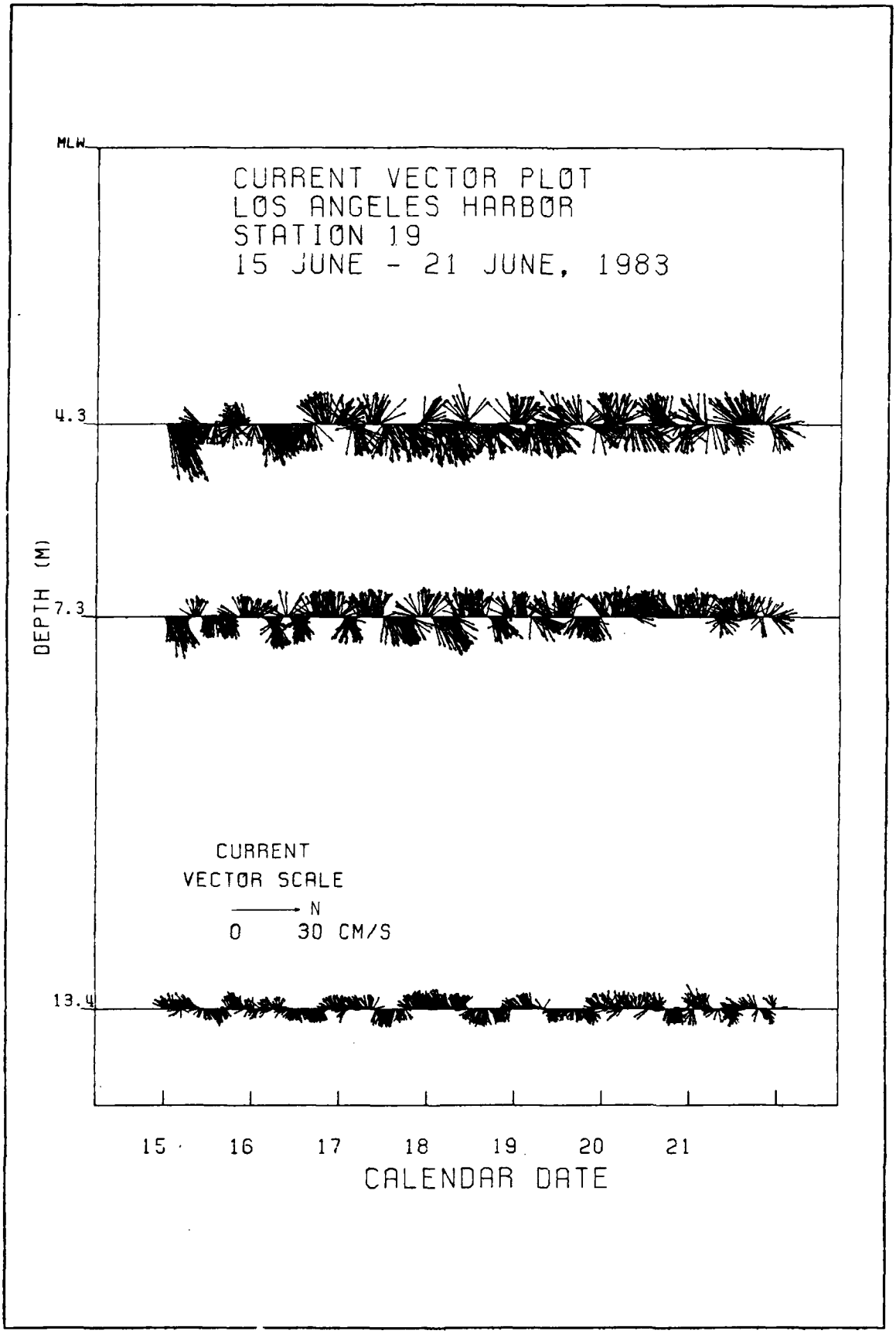

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 15
14 JULY - 20 JULY, 1983
MLW
4.3
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
14 15 16 17 18 19 20
CALENDAR DATE

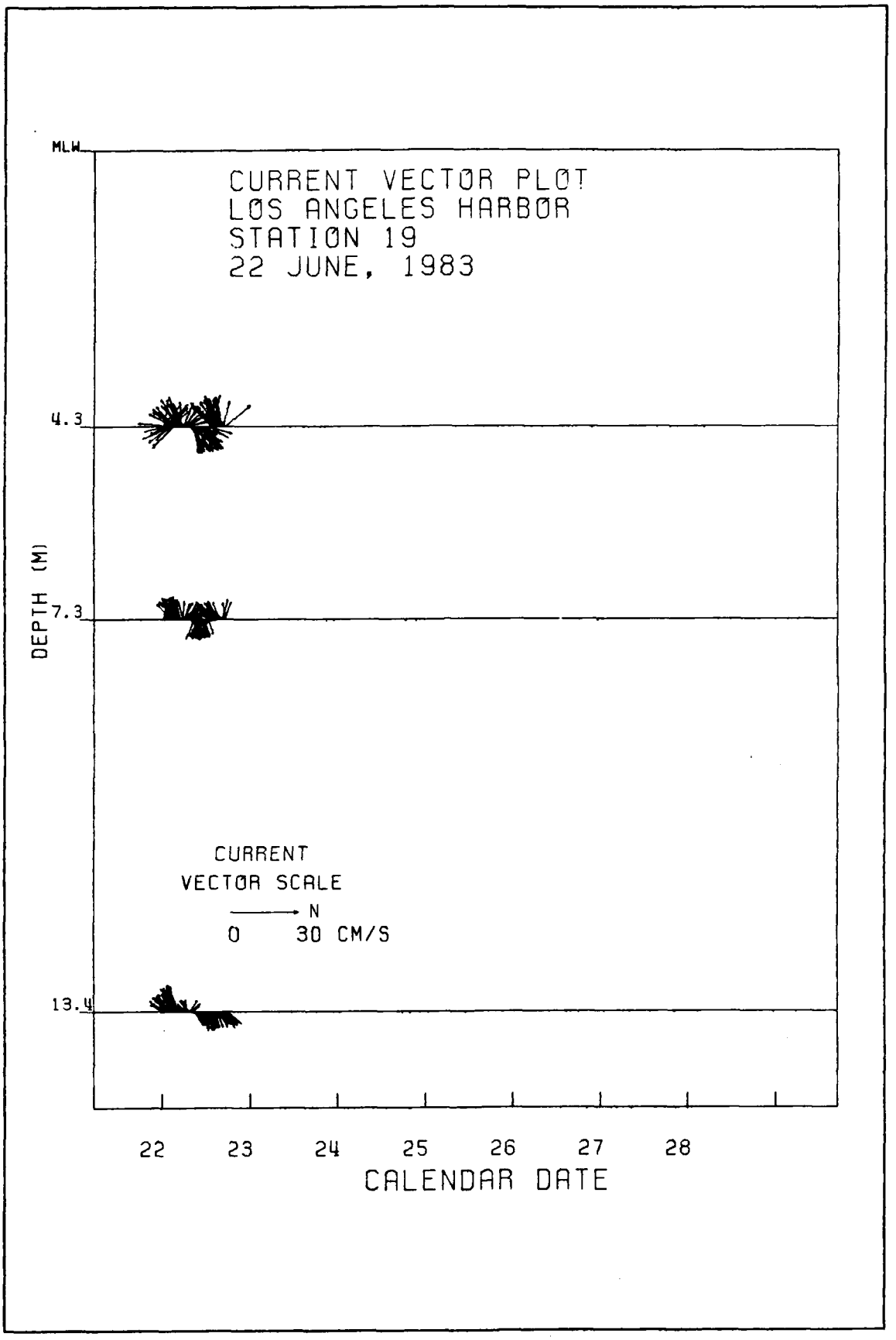

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 15
21 JULY - 27 JULY, 1983
4.3
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
21 22 23 24 25 26 27
CALENDAR DATE

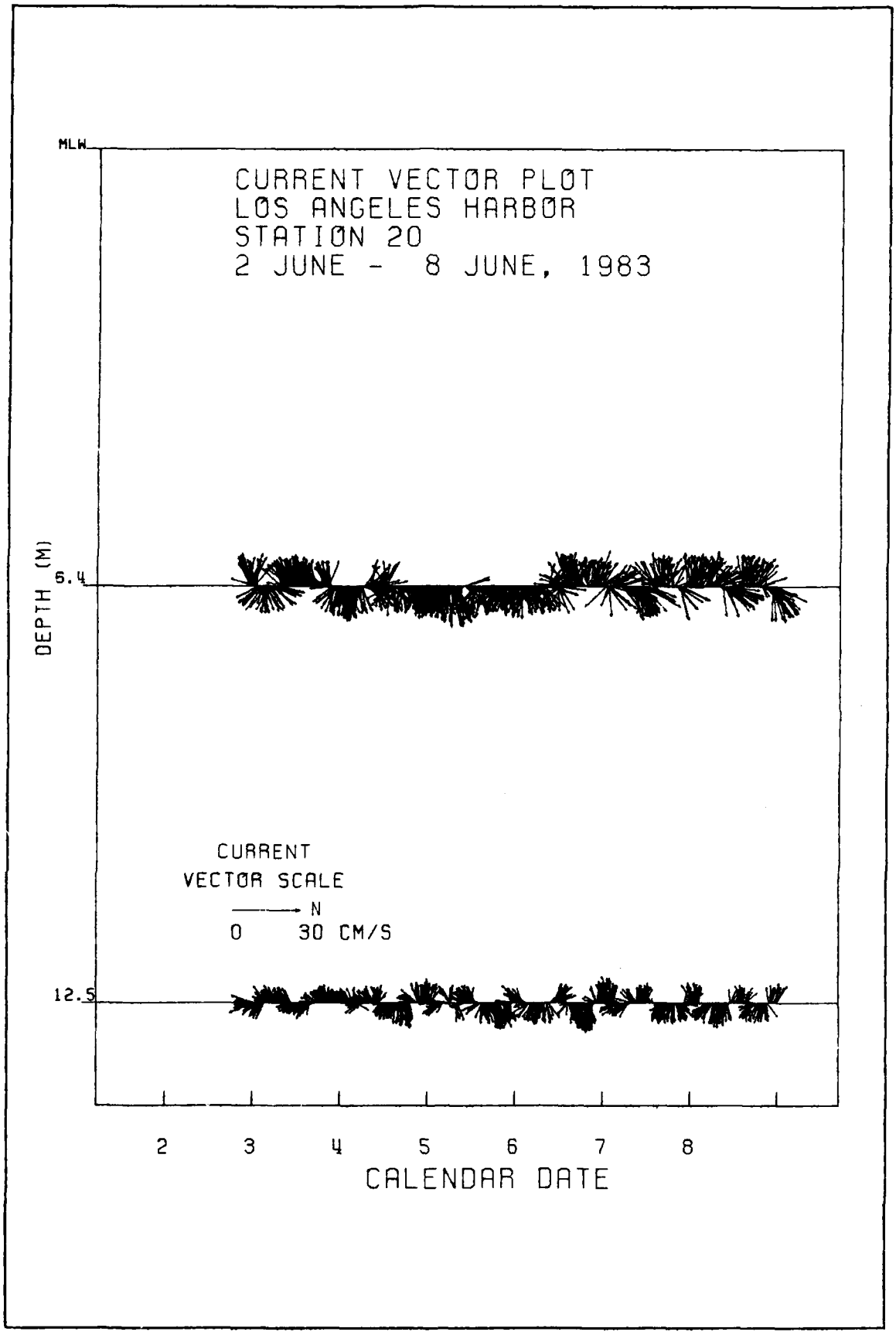

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 15
28 JULY - 2 AUGUST, 1983
MLW
4.3
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
28
29
30
31
1
2
3
CALENDAR DATE

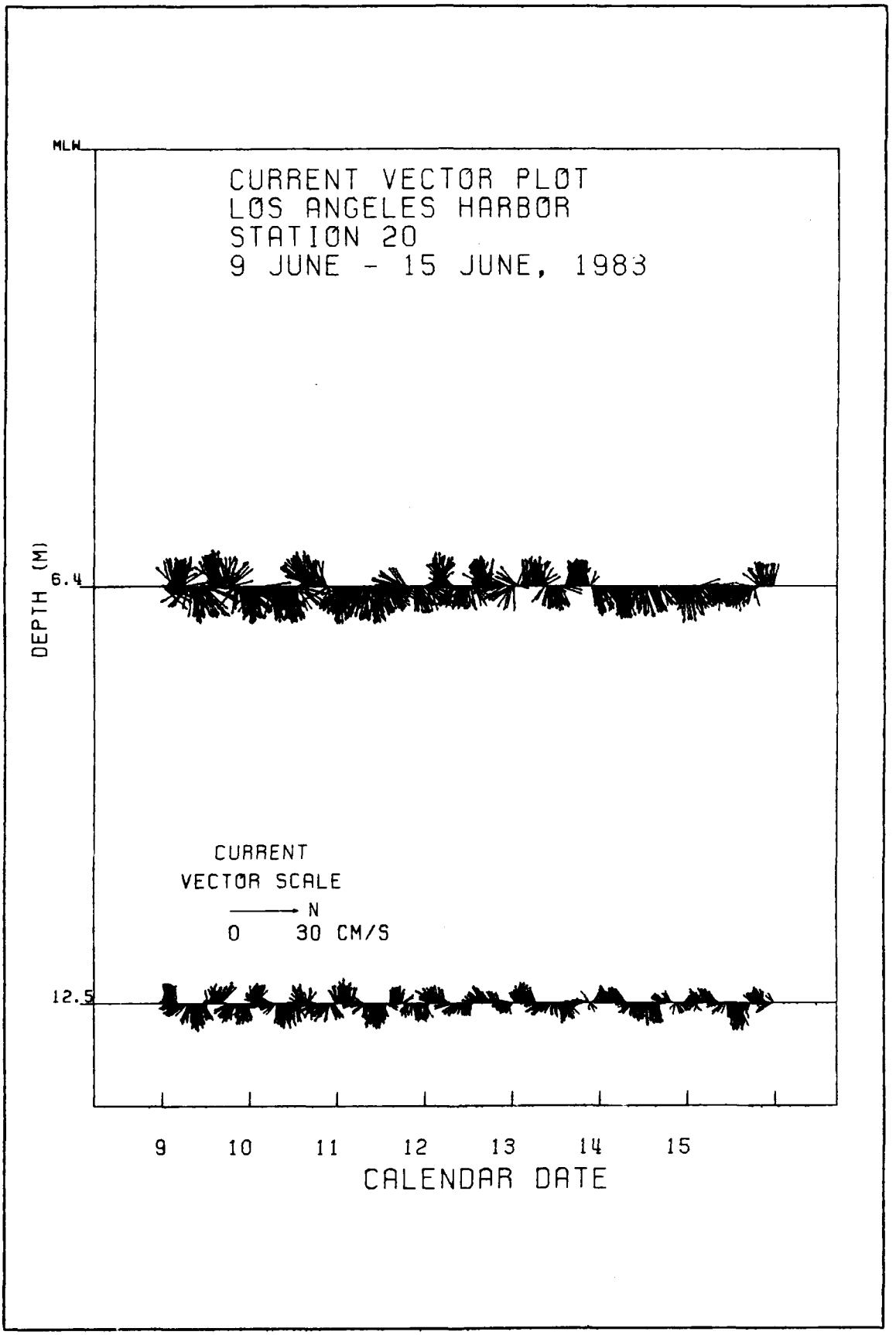

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 19
1 JUNE - 7 JUNE, 1983
MLW
4.3
7.3
13.4
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
1
2
3
4
5
6
7
CALENDAR DATE

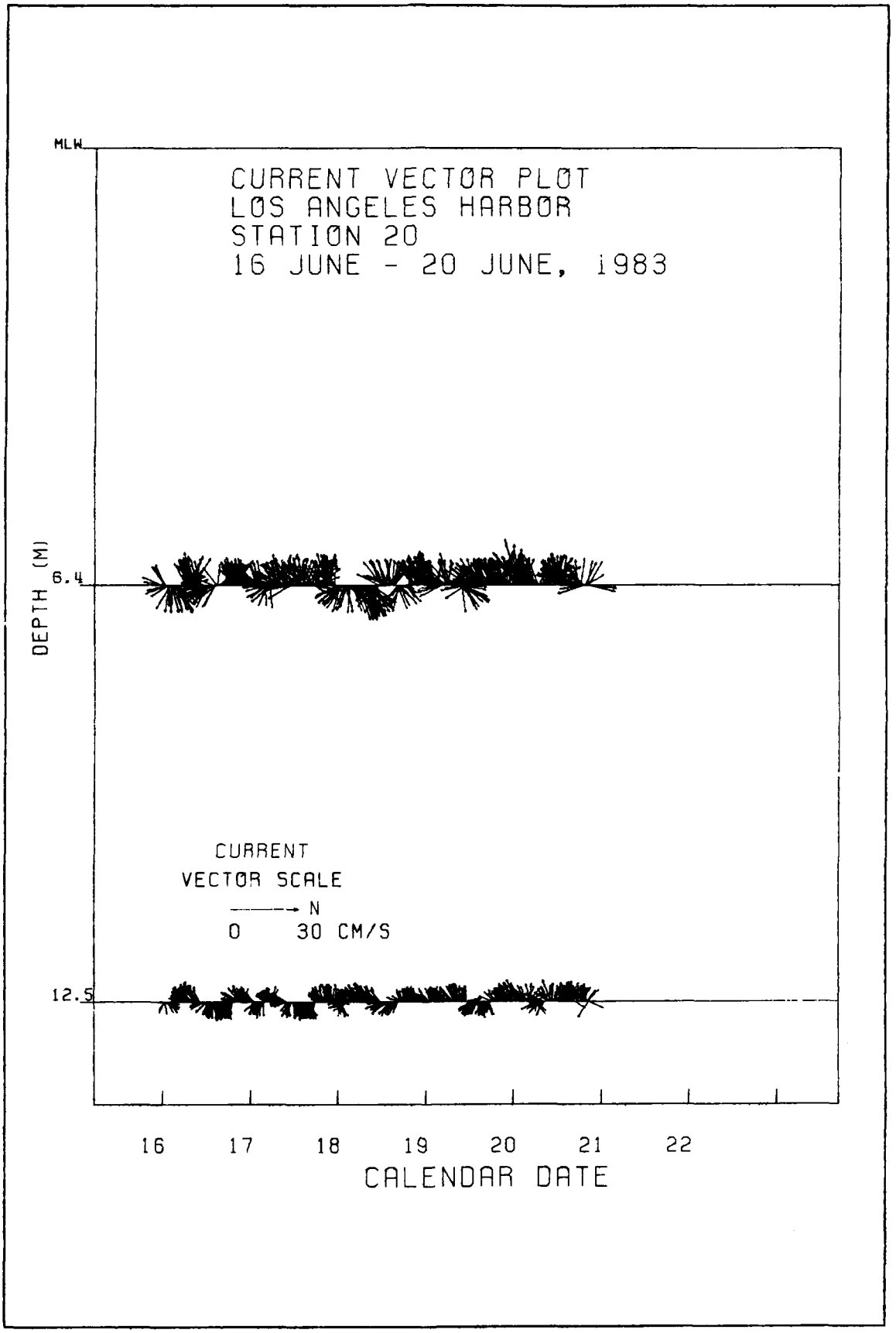

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 19
8 JUNE - 14 JUNE, 1983
MLW
4.3
7.3
13.4
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
8
9
10
11
12
13
14
CALENDAR DATE

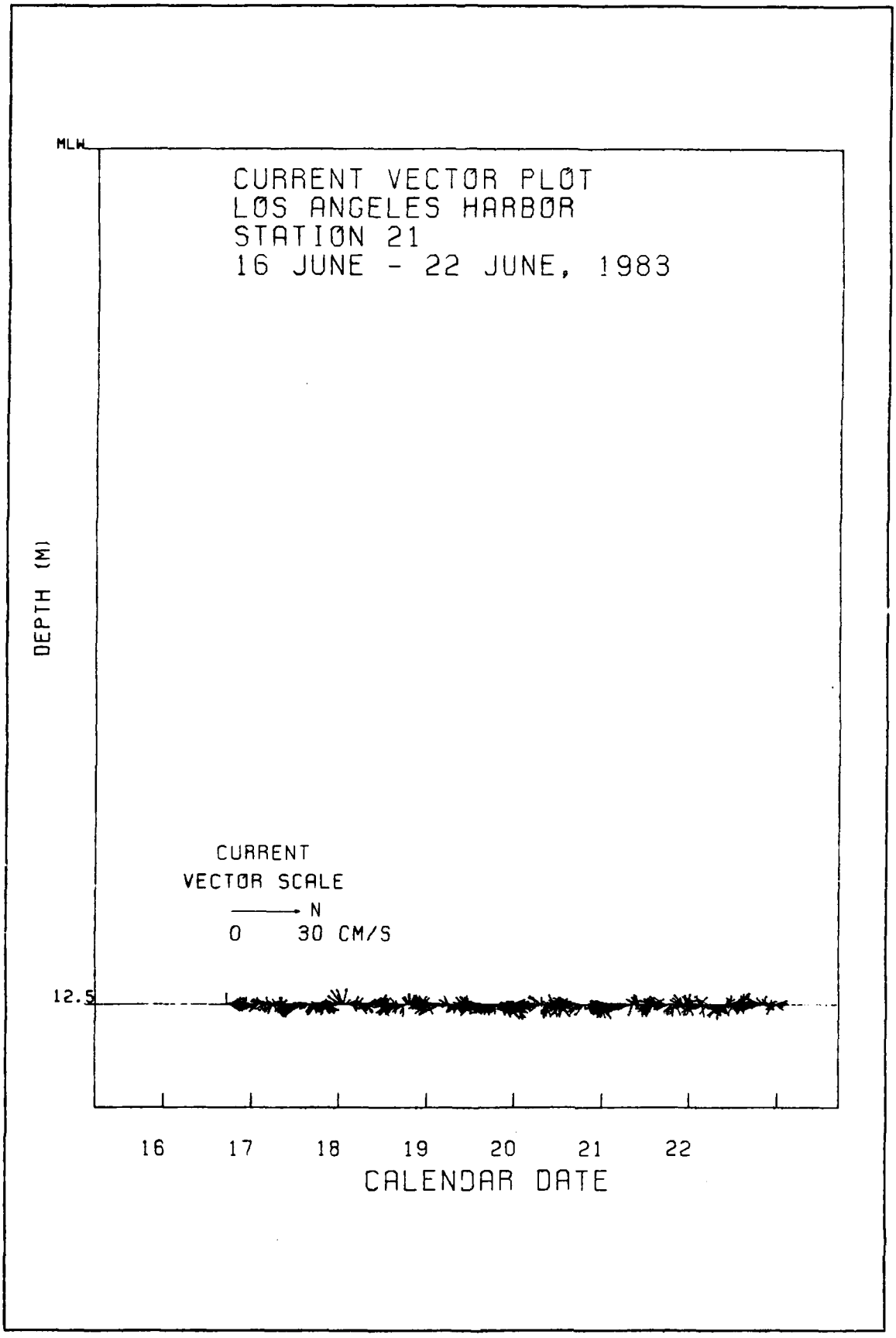

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 19
15 JUNE - 21 JUNE, 1983
MLW
4.3
7.3
13.4
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
15
16
17
18
19
20
21
CALENDAR DATE

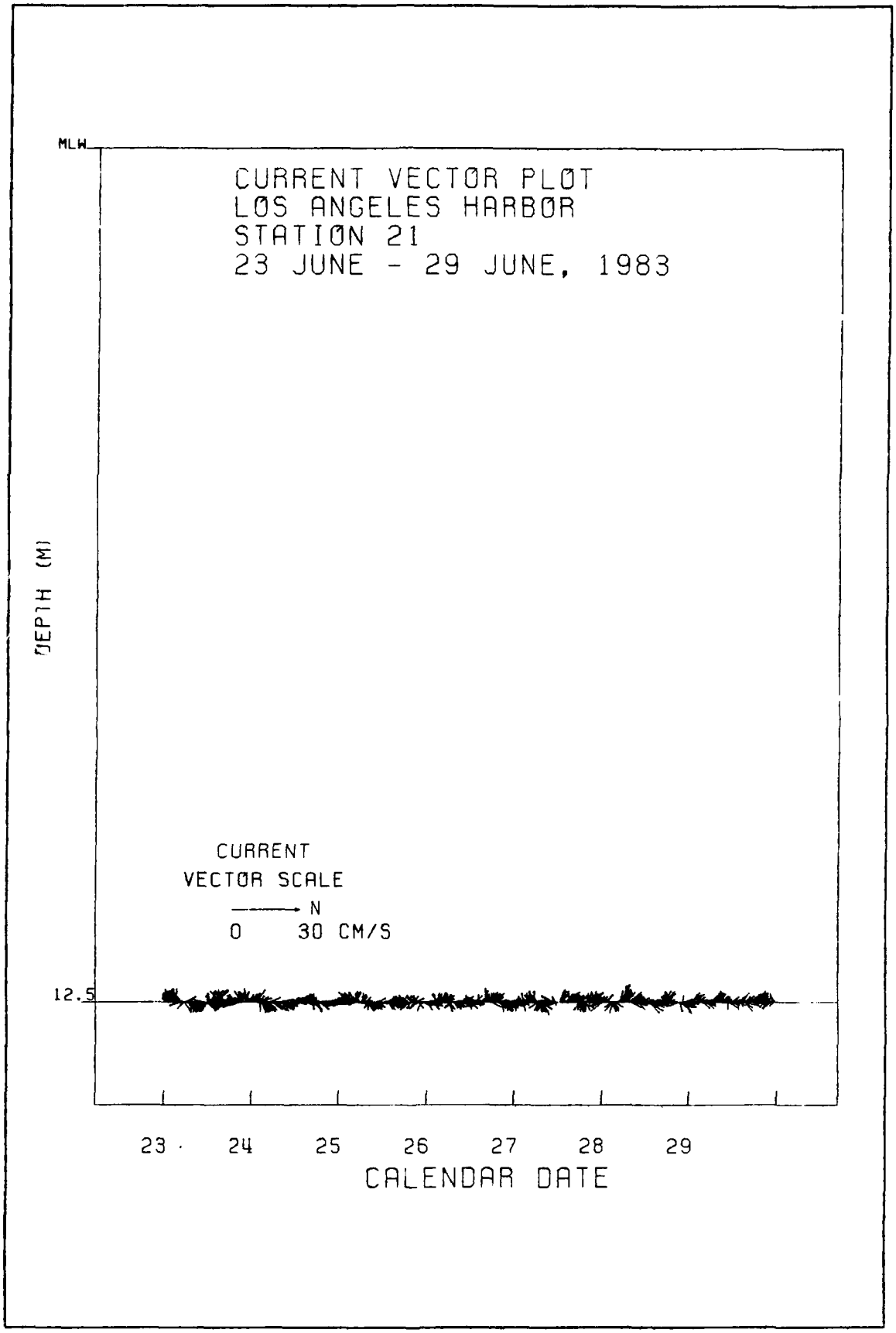

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 19
22 JUNE, 1983
MLW
4.3
7.3
13.4
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
22
23
24
25
26
27
28
CALENDAR DATE

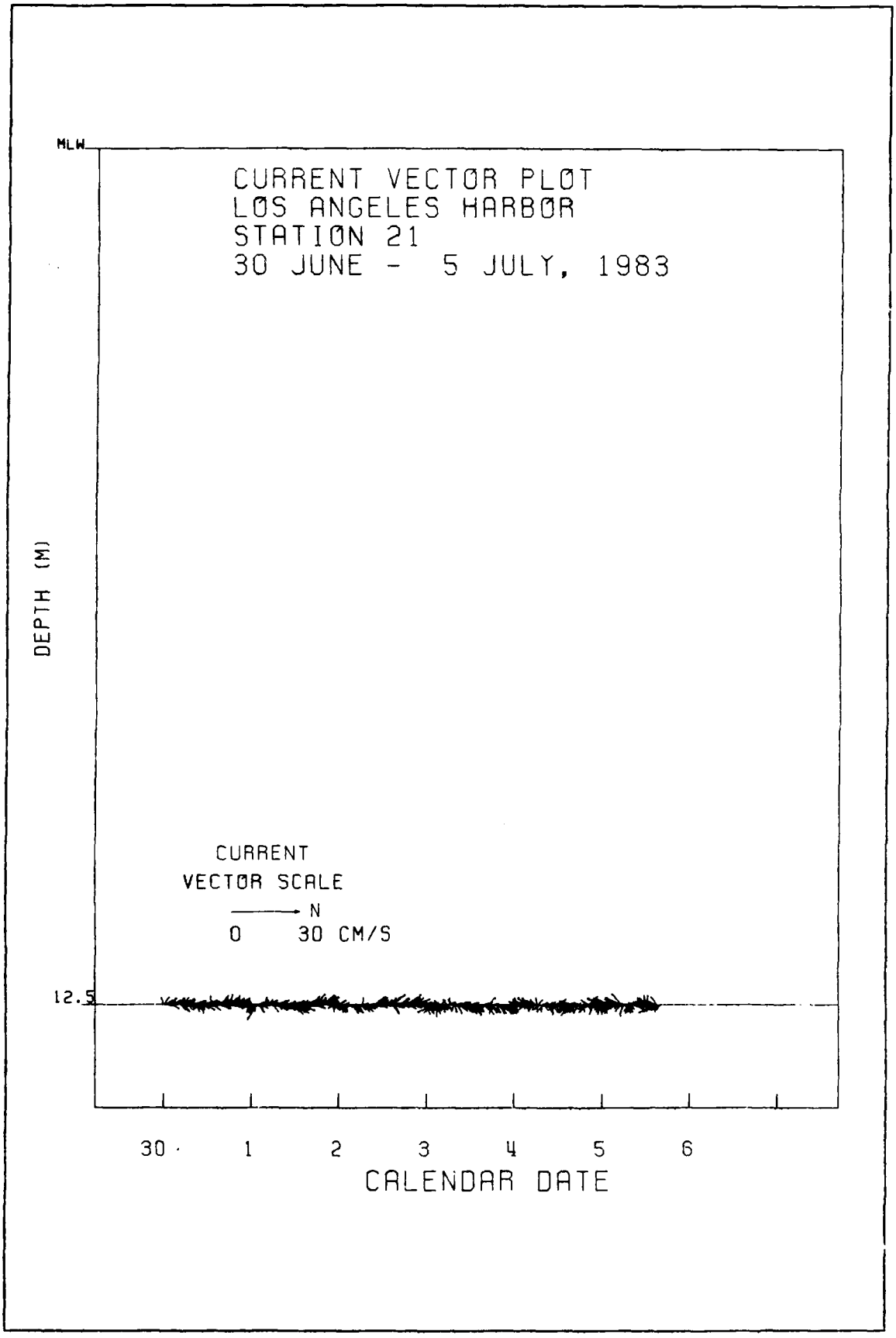

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 20
2 JUNE - 8 JUNE, 1983
MLW
DEPTH (M)
6.4
12.5
CURRENT
VECTOR SCALE
N
0 30 CM/S
2
3
4
5
6
7
8
CALENDAR DATE

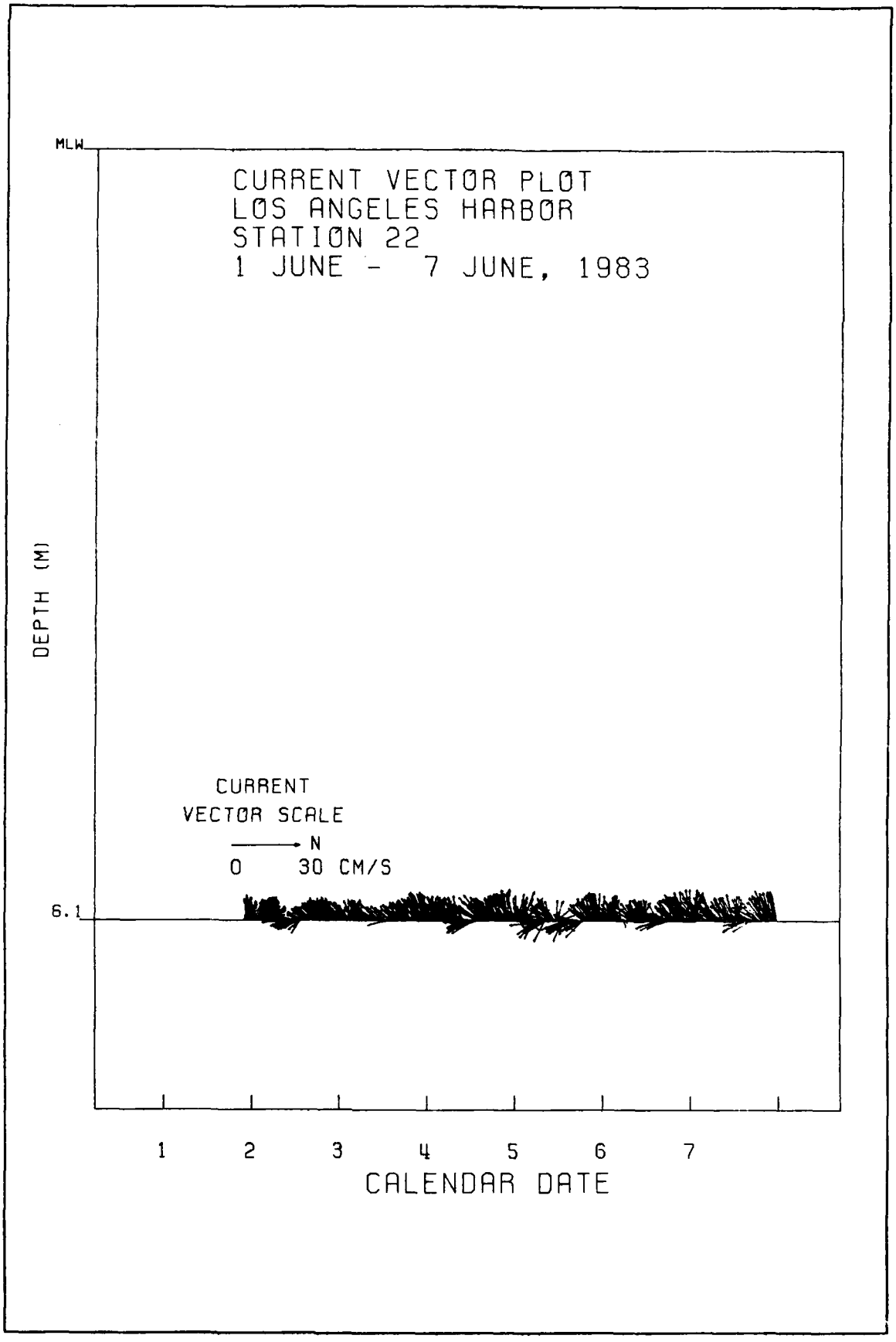

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 20
9 JUNE - 15 JUNE, 1983
DEPTH (M)
6.4
CURRENT
VECTOR SCALE
N
0 30 CM/S
12.5
9 10 11 12 13 14 15
CALENDAR DATE

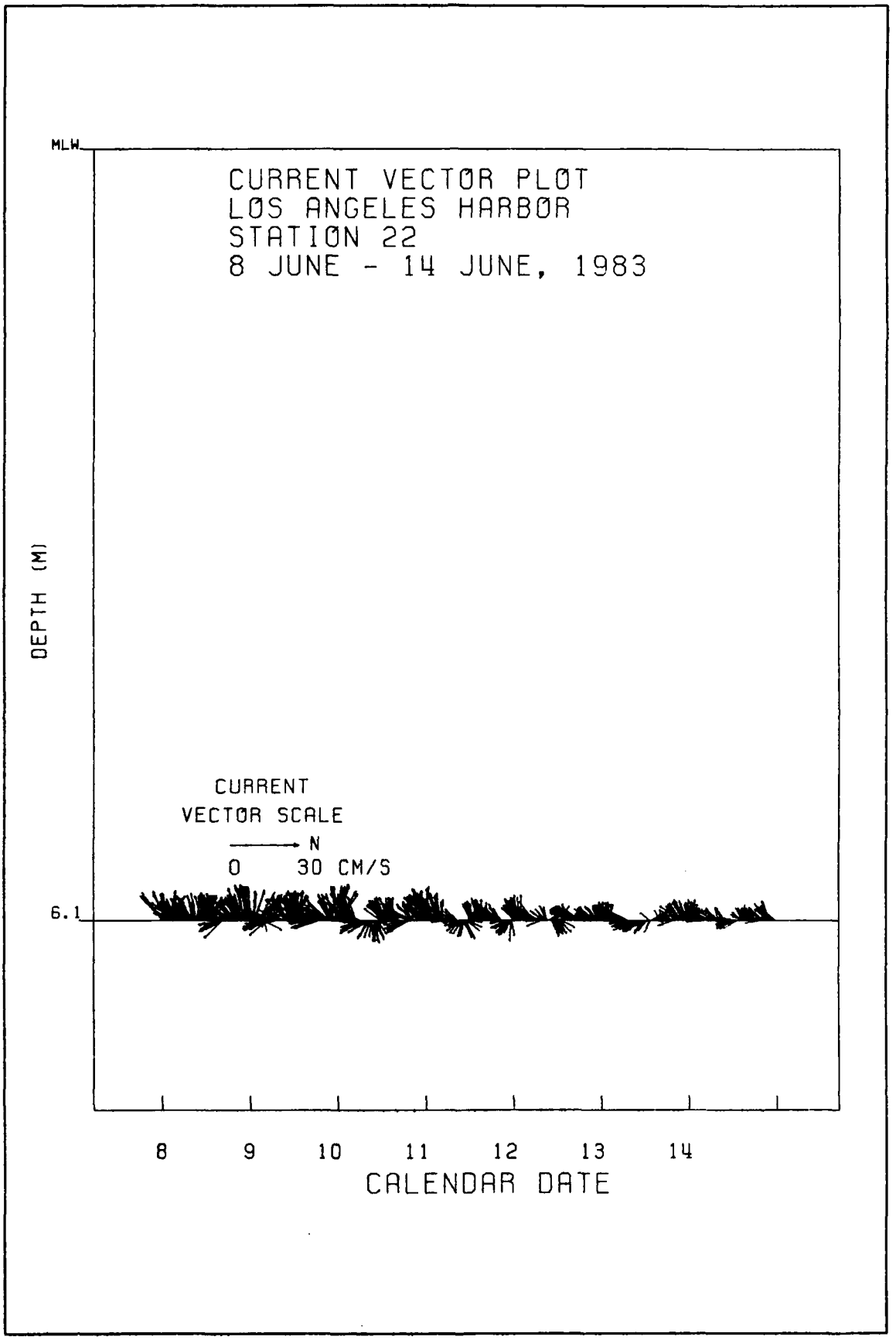

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 20
16 JUNE - 20 JUNE, 1983
DEPTH (M)
6.4
CURRENT
VECTOR SCALE
N
0 30 CM/S
12.5
16
17
18
19
20
21
22
CALENDAR DATE

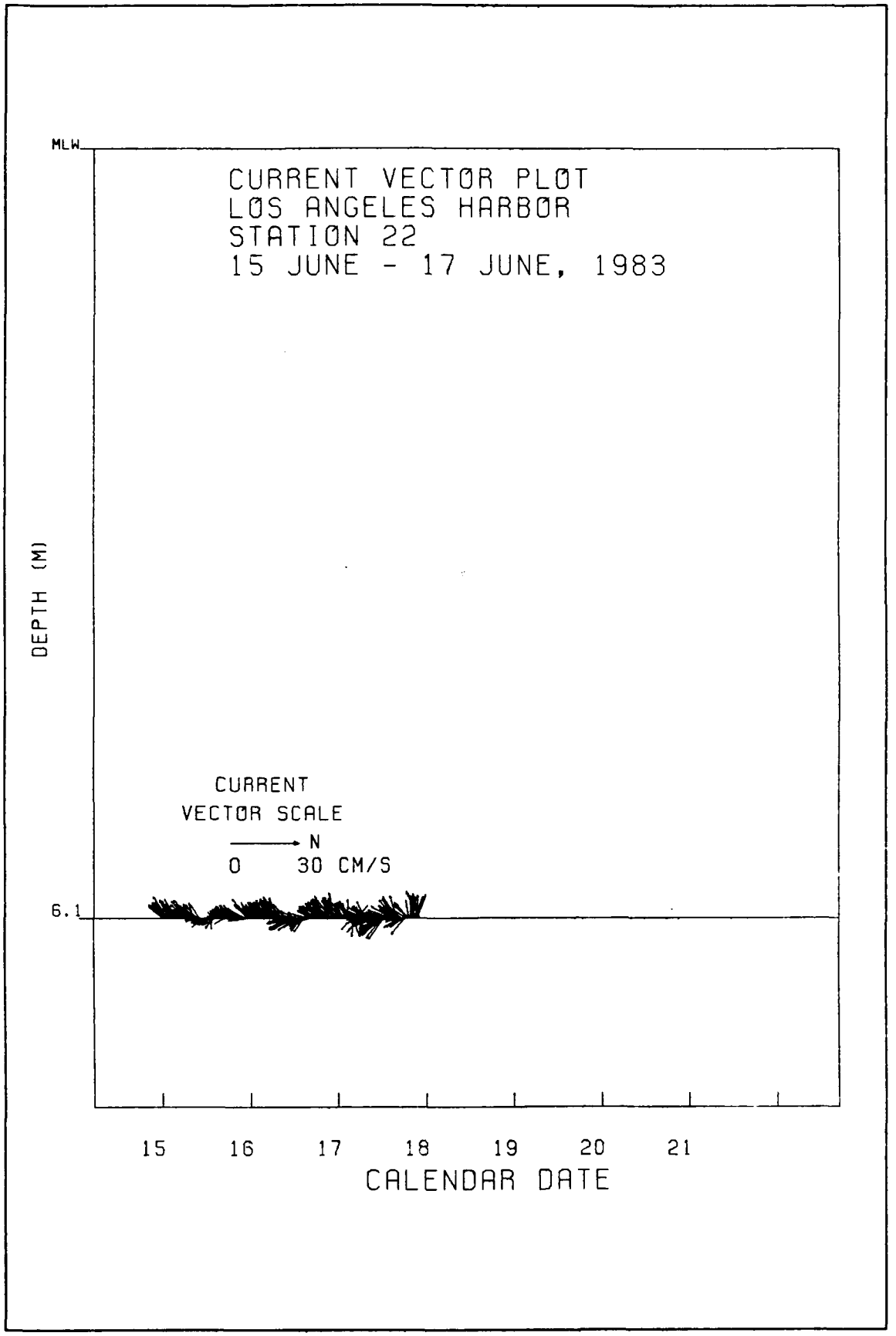

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 21
16 JUNE - 22 JUNE, 1983
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
12.5
16
17
18
19
20
21
22
CALENDAR DATE

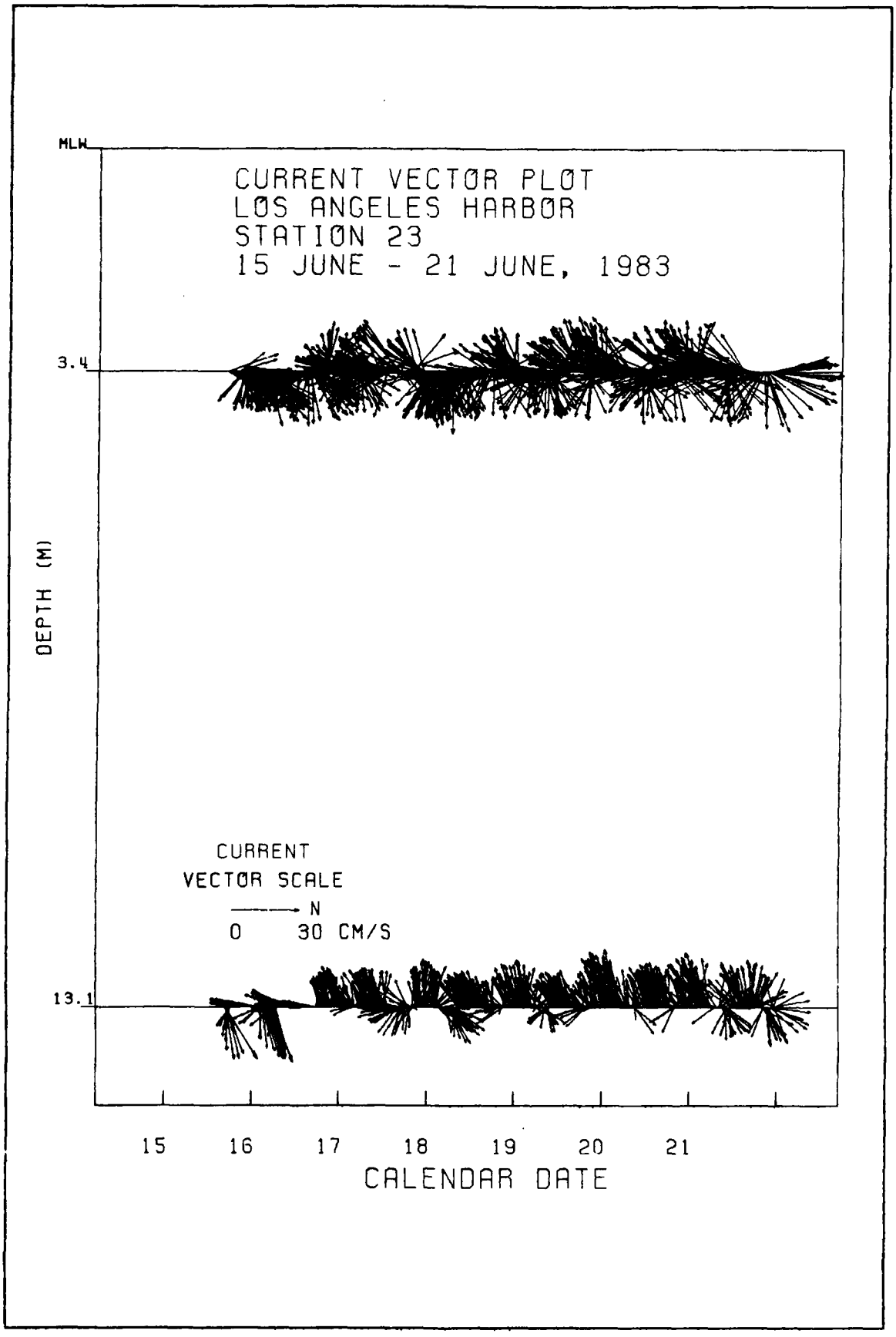

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 21
23 JUNE - 29 JUNE, 1983
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
12.5
23
24
25
26
27
28
29
CALENDAR DATE

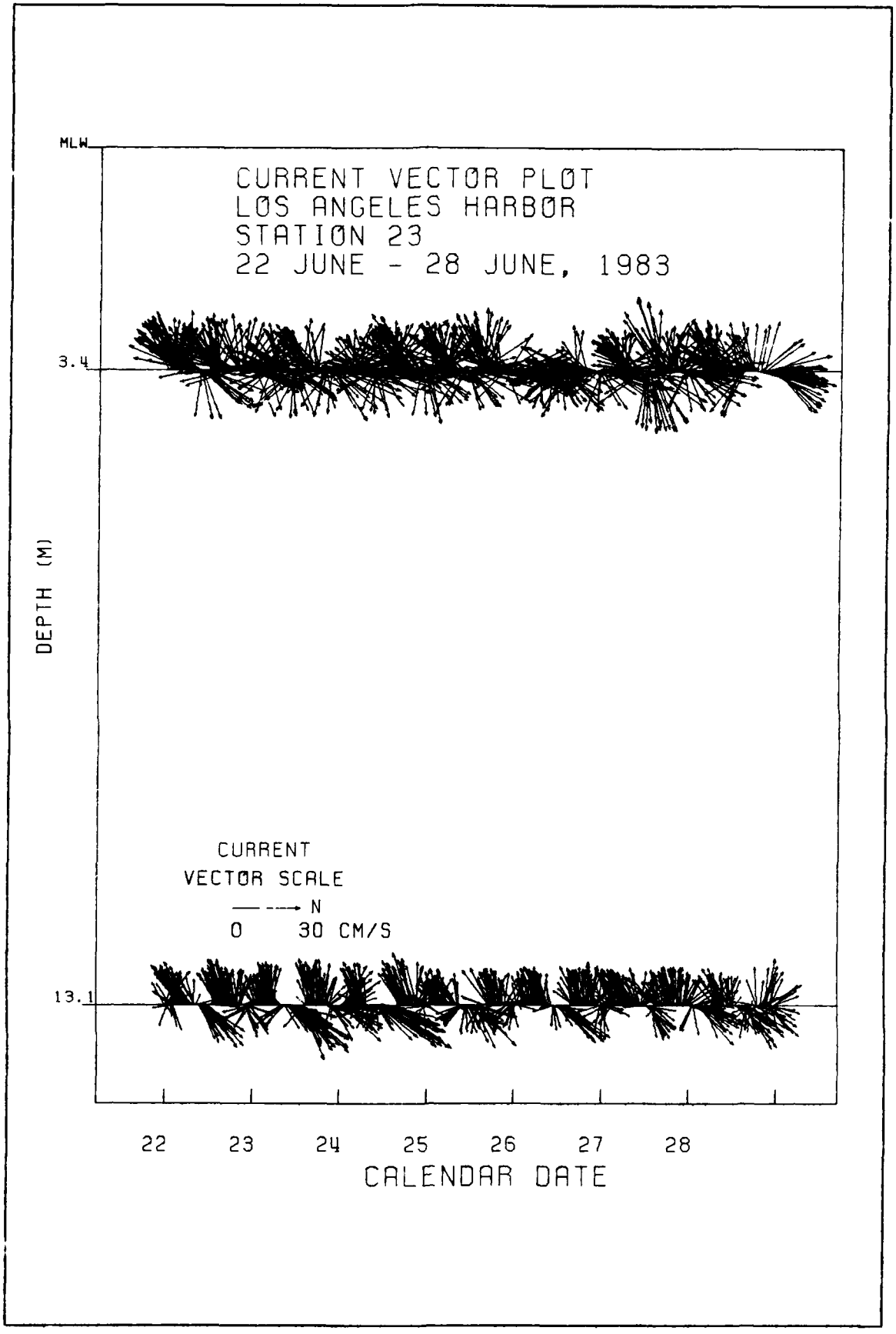

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 21
30 JUNE - 5 JULY, 1983
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
12.5
30
1
2
3
4
5
6
CALENDAR DATE

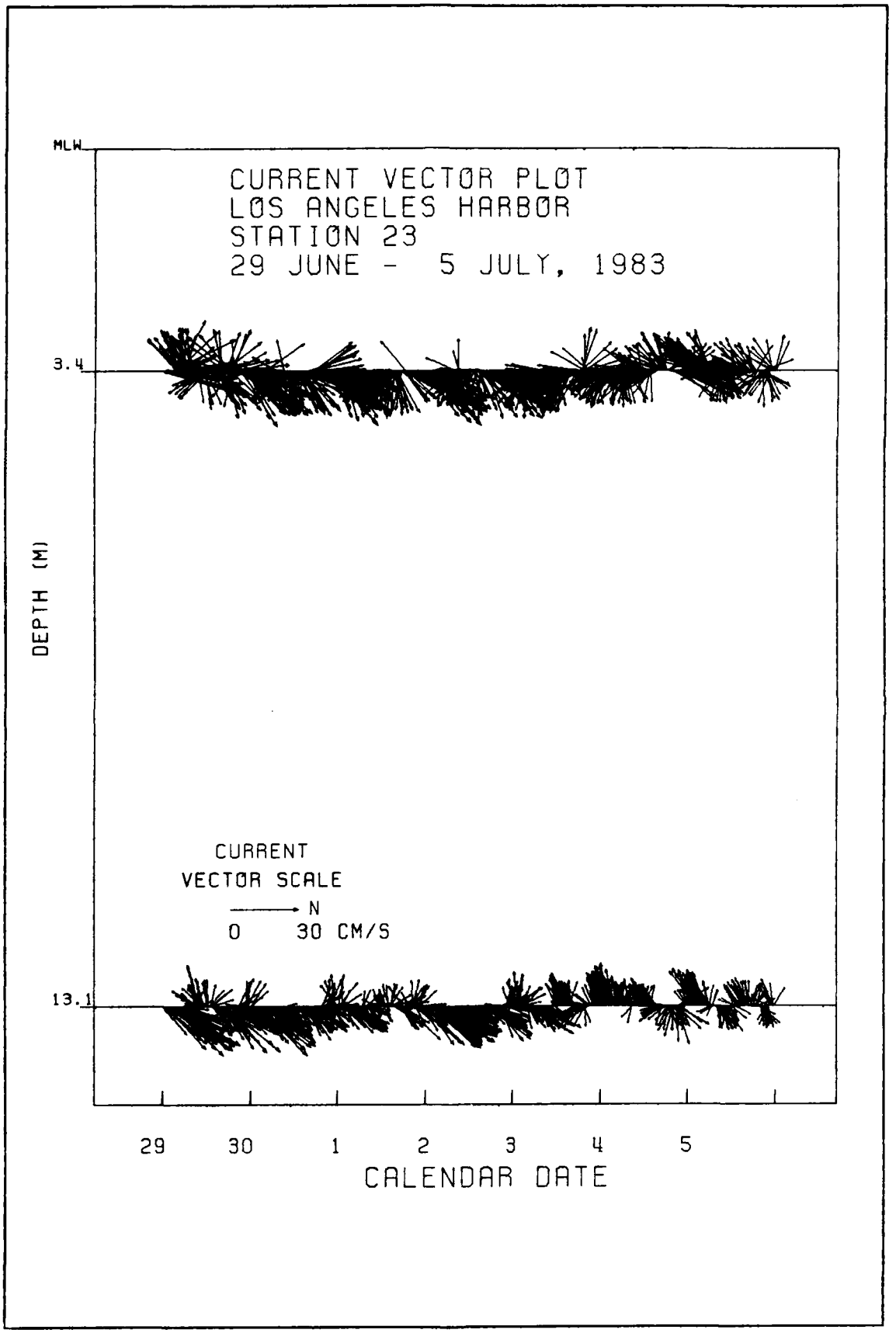

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 22
1 JUNE - 7 JUNE, 1983
MLW
DEPTH (M)
6.1
CURRENT
VECTOR SCALE
N
0 30 CM/S
1
2
3
4
5
6
7
CALENDAR DATE

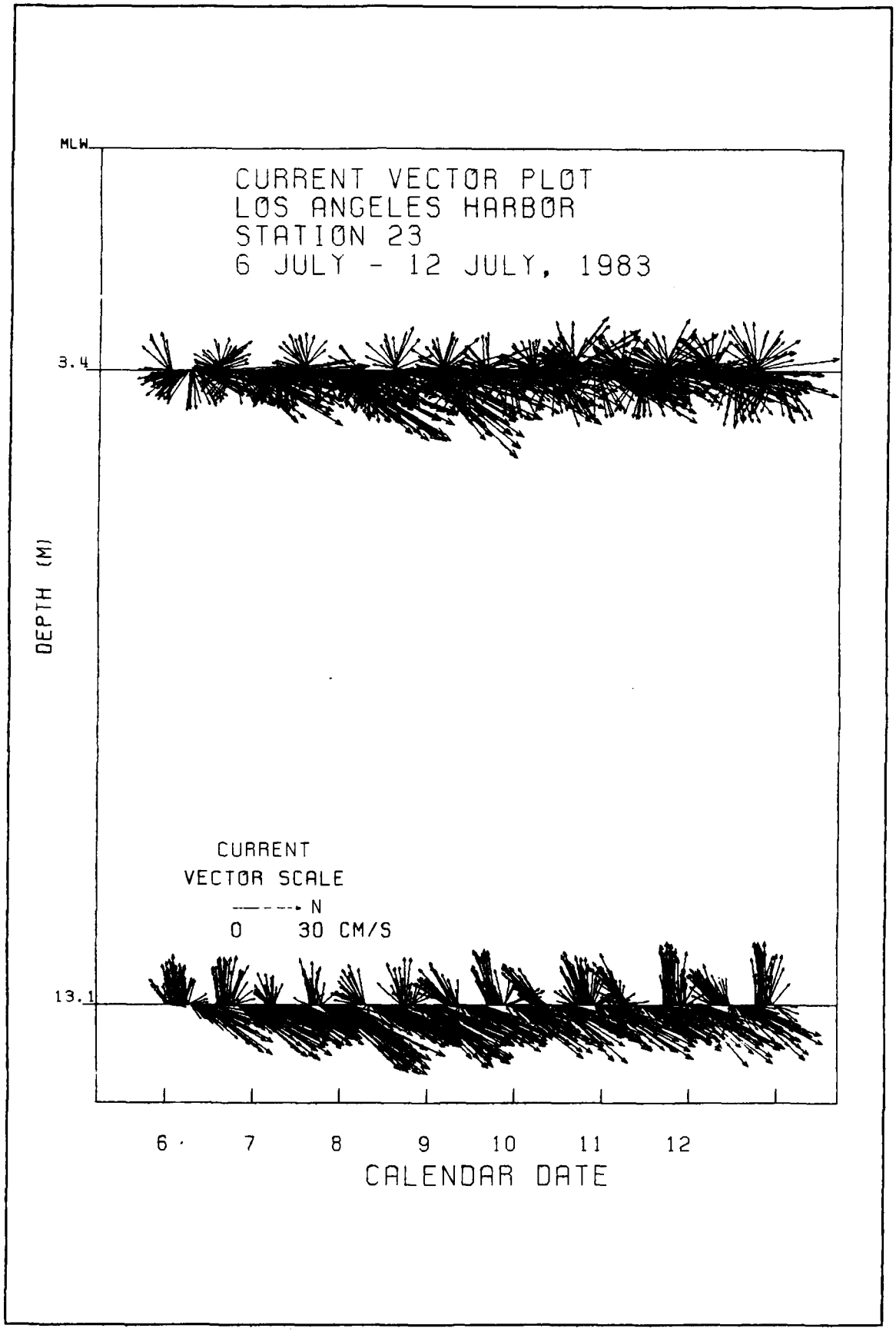

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 22
8 JUNE - 14 JUNE, 1983
MLW
DEPTH (M)
6.1
CURRENT
VECTOR SCALE
N
0 30 CM/S
8
9
10
11
12
13
14
CALENDAR DATE

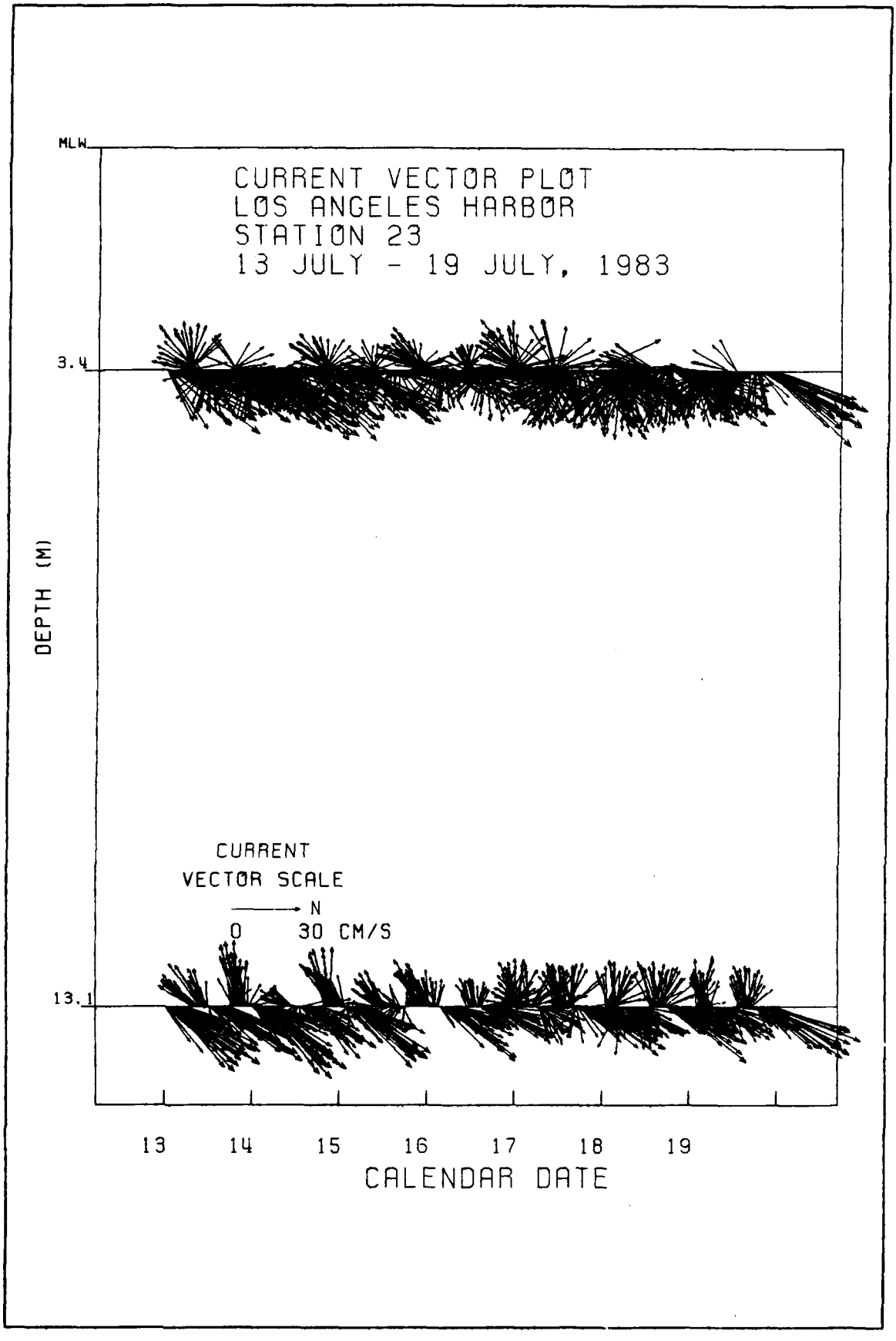

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 22
15 JUNE - 17 JUNE, 1983
MLW
DEPTH (M)
6.1
CURRENT
VECTOR SCALE
N
0 30 CM/S
15
16
17
18
19
20
21
CALENDAR DATE

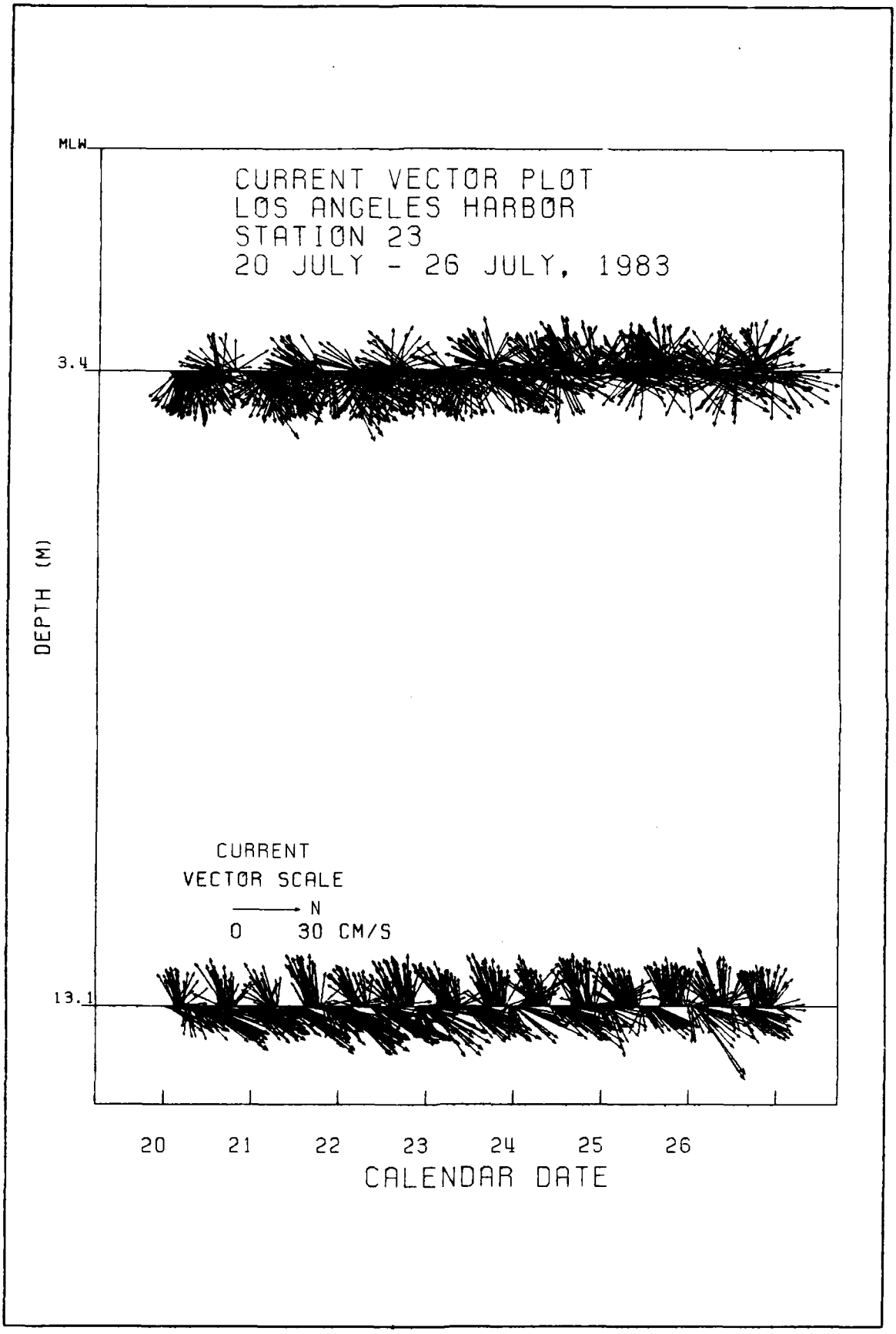

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 23
15 JUNE - 21 JUNE, 1983
MLW
3.4
13.1
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
15
16
17
18
19
20
21
CALENDAR DATE

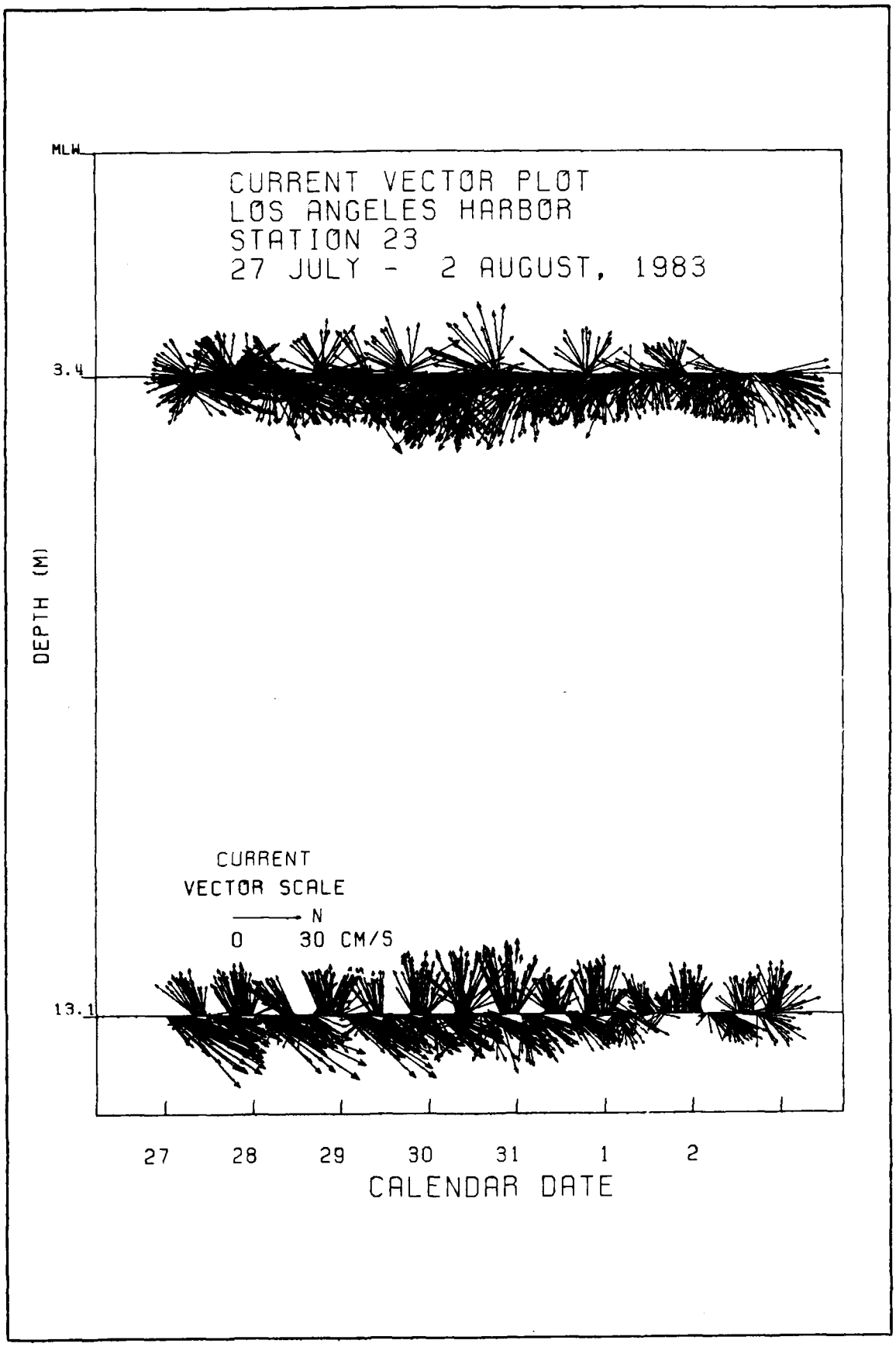

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 23
22 JUNE - 28 JUNE, 1983
3.4
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
13.1
22 23 24 25 26 27 28
CALENDAR DATE

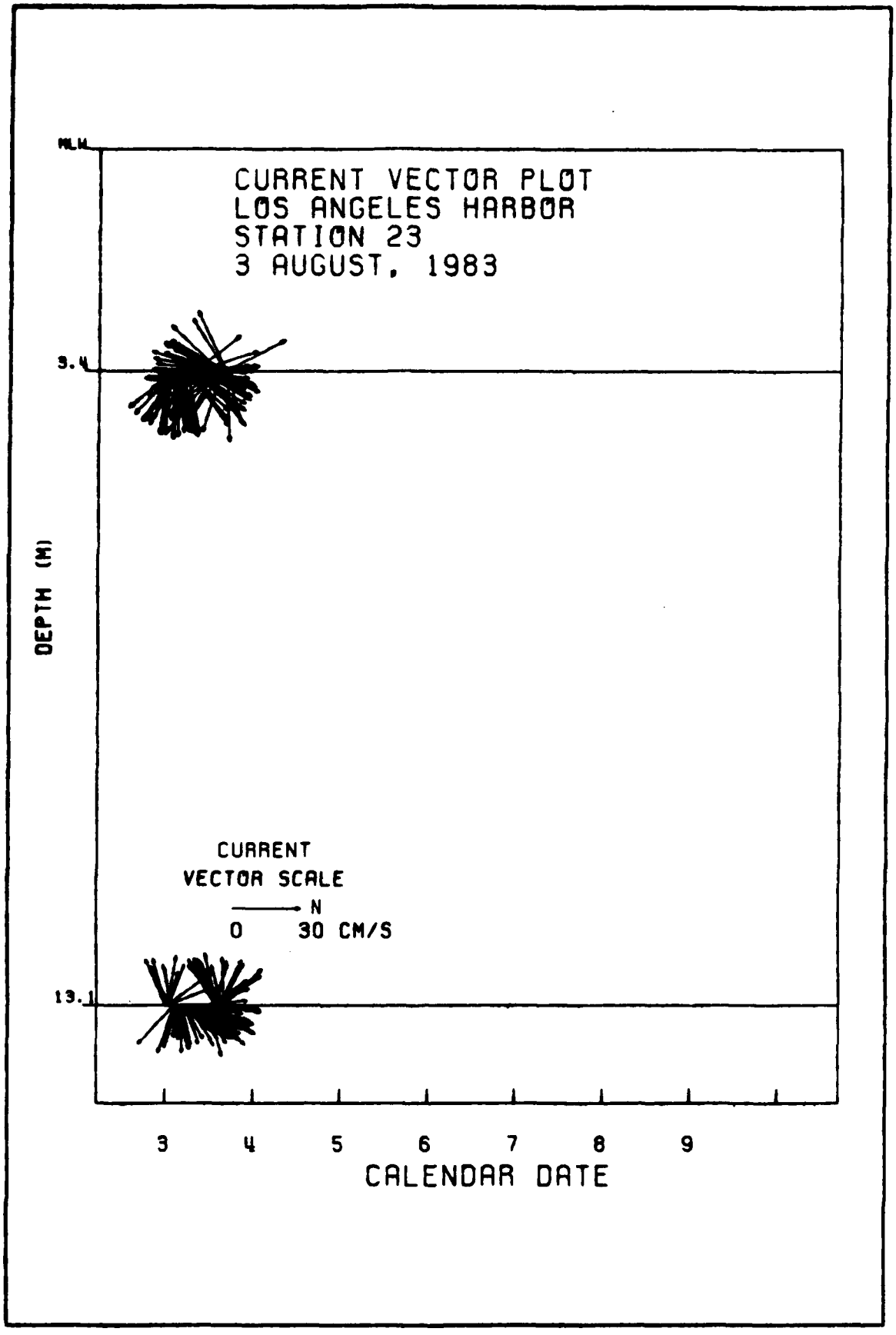

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 23
29 JUNE - 5 JULY, 1983
3.4
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
13.1
29
30
1
2
3
4
5
CALENDAR DATE

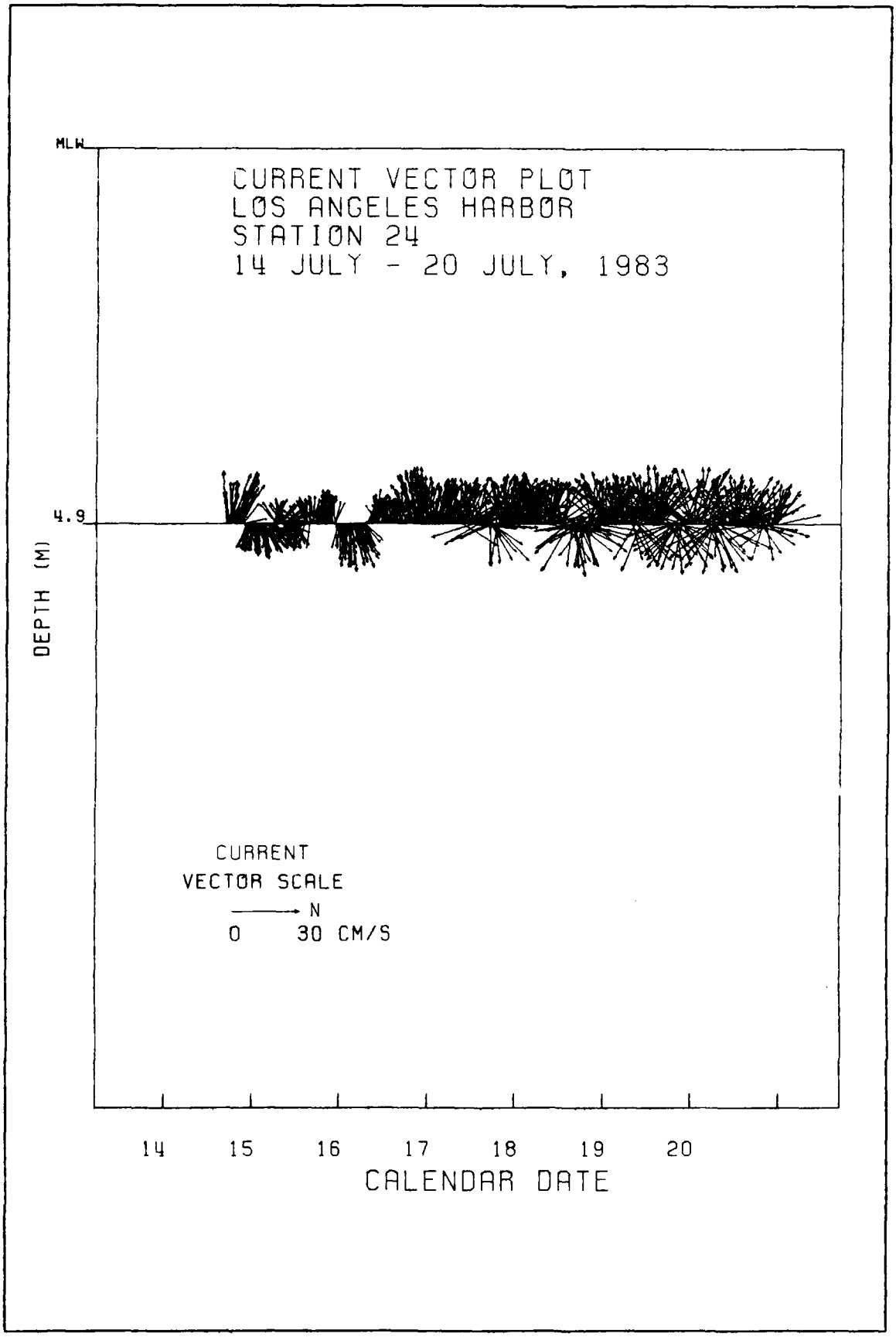

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 23
6 JULY - 12 JULY, 1983
3.4
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
13.1
6
7
8
9
10
11
12
CALENDAR DATE

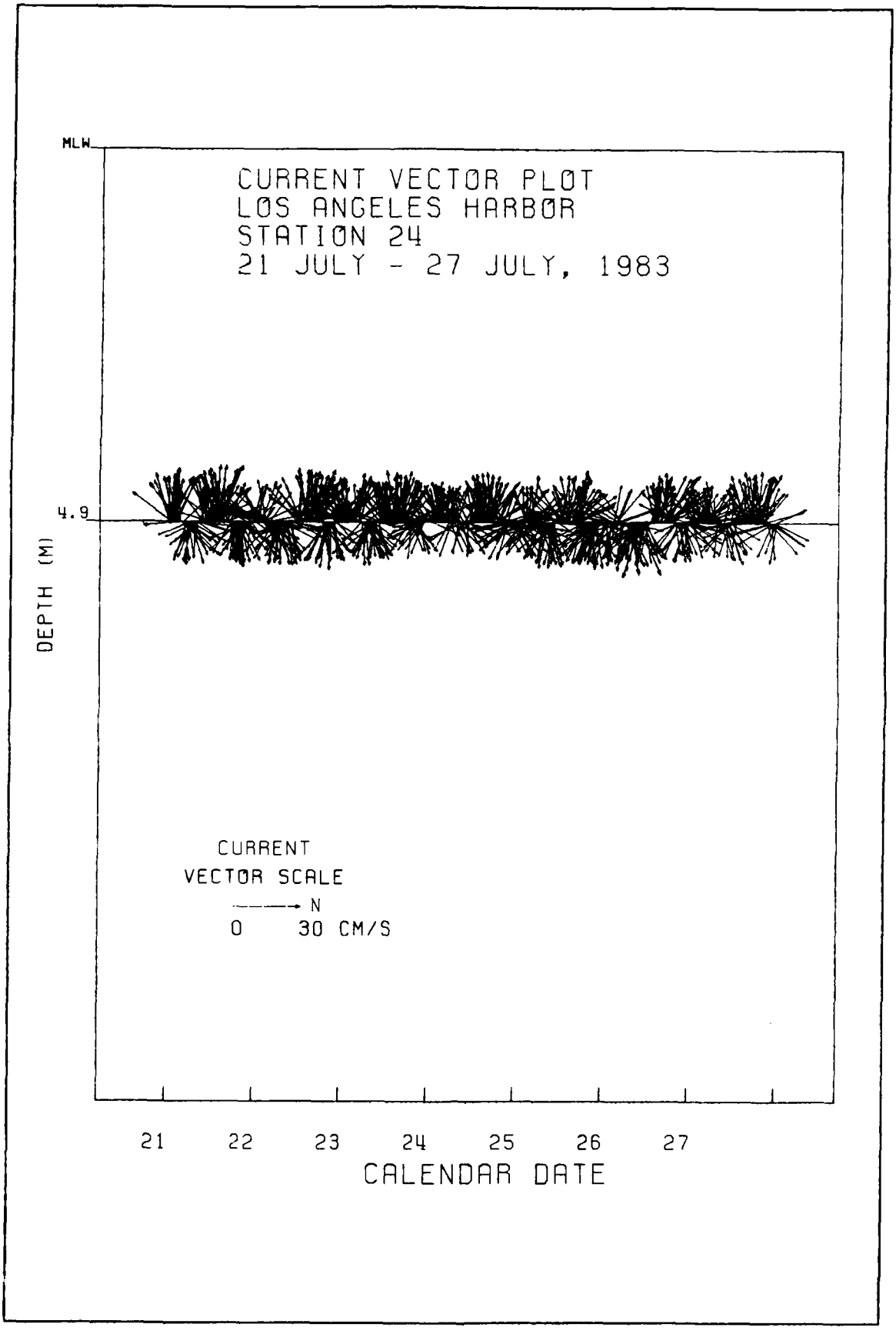

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 23
13 JULY - 19 JULY, 1983
3.4
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
13.1
13 14 15 16 17 18 19
CALENDAR DATE

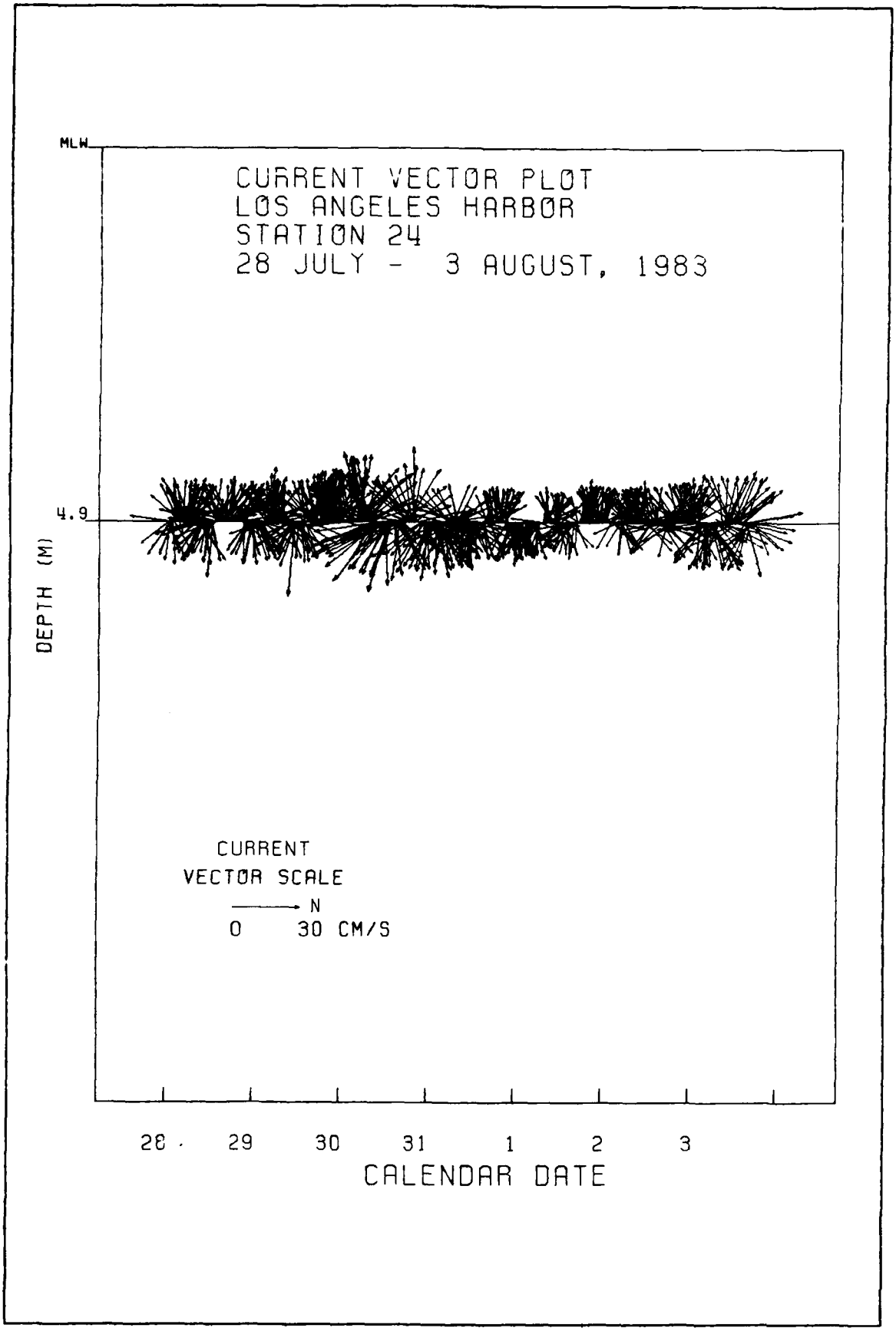

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 23
20 JULY - 26 JULY, 1983
MLW
3.4
13.1
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
20
21
22
23
24
25
26
CALENDAR DATE

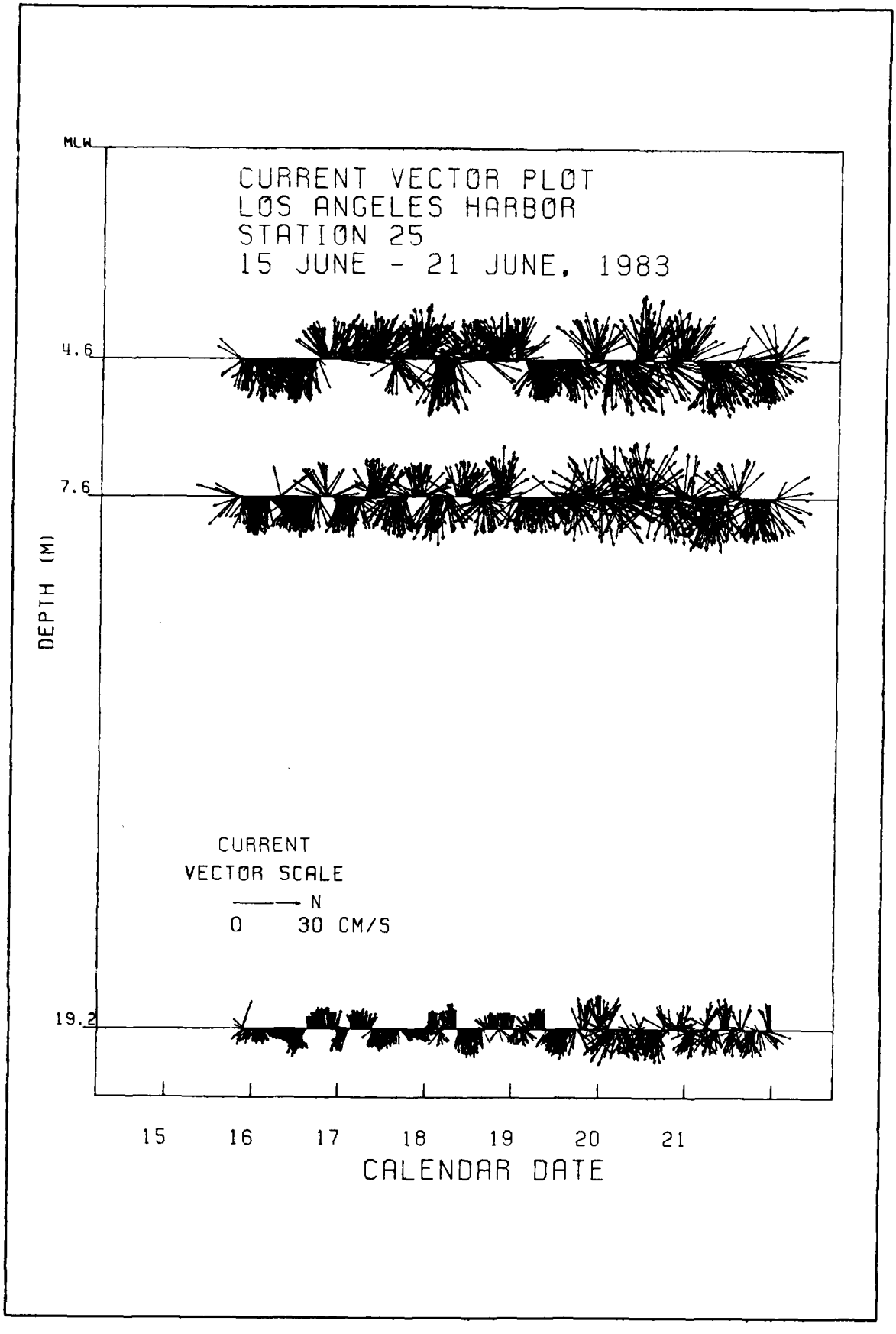

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 23
27 JULY - 2 AUGUST, 1983
MLW
3.4
13.1
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
27 28 29 30 31 1 2
CALENDAR DATE

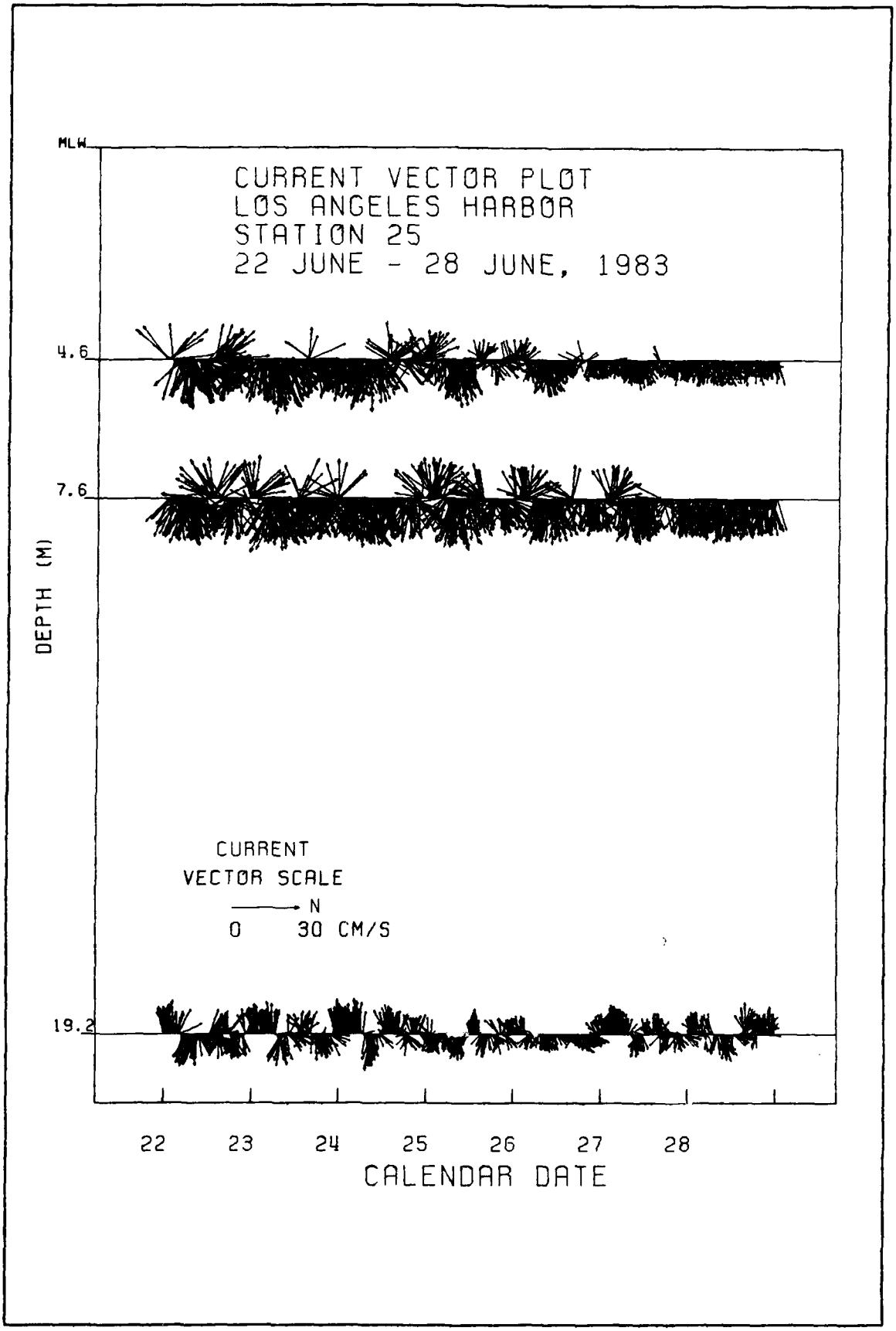

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 23
3 AUGUST, 1983
MLW
3.4
13.1
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
3 4 5 6 7 8 9
CALENDAR DATE

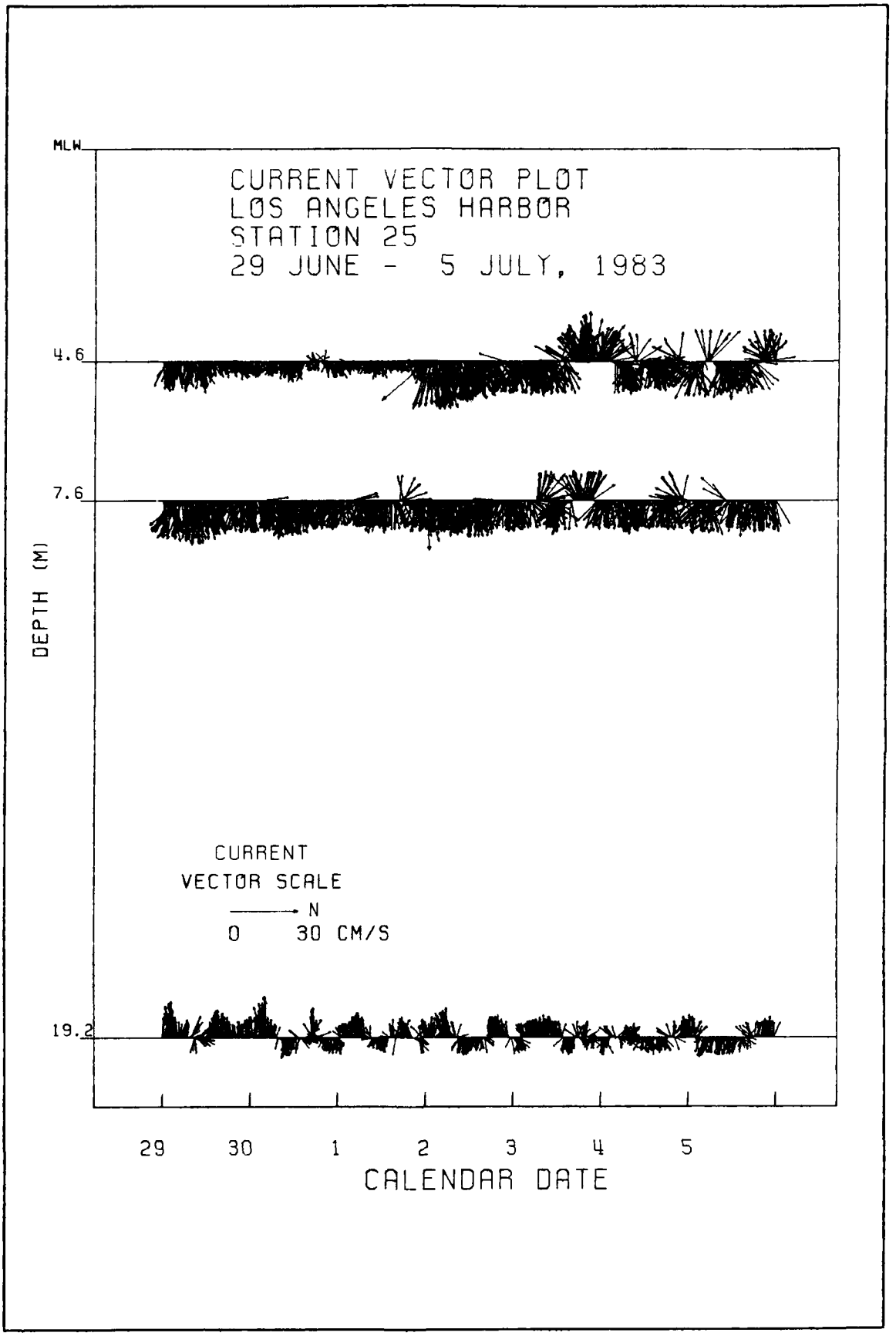

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 24
14 JULY - 20 JULY, 1983
4.9
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
14 15 16 17 18 19 20
CALENDAR DATE

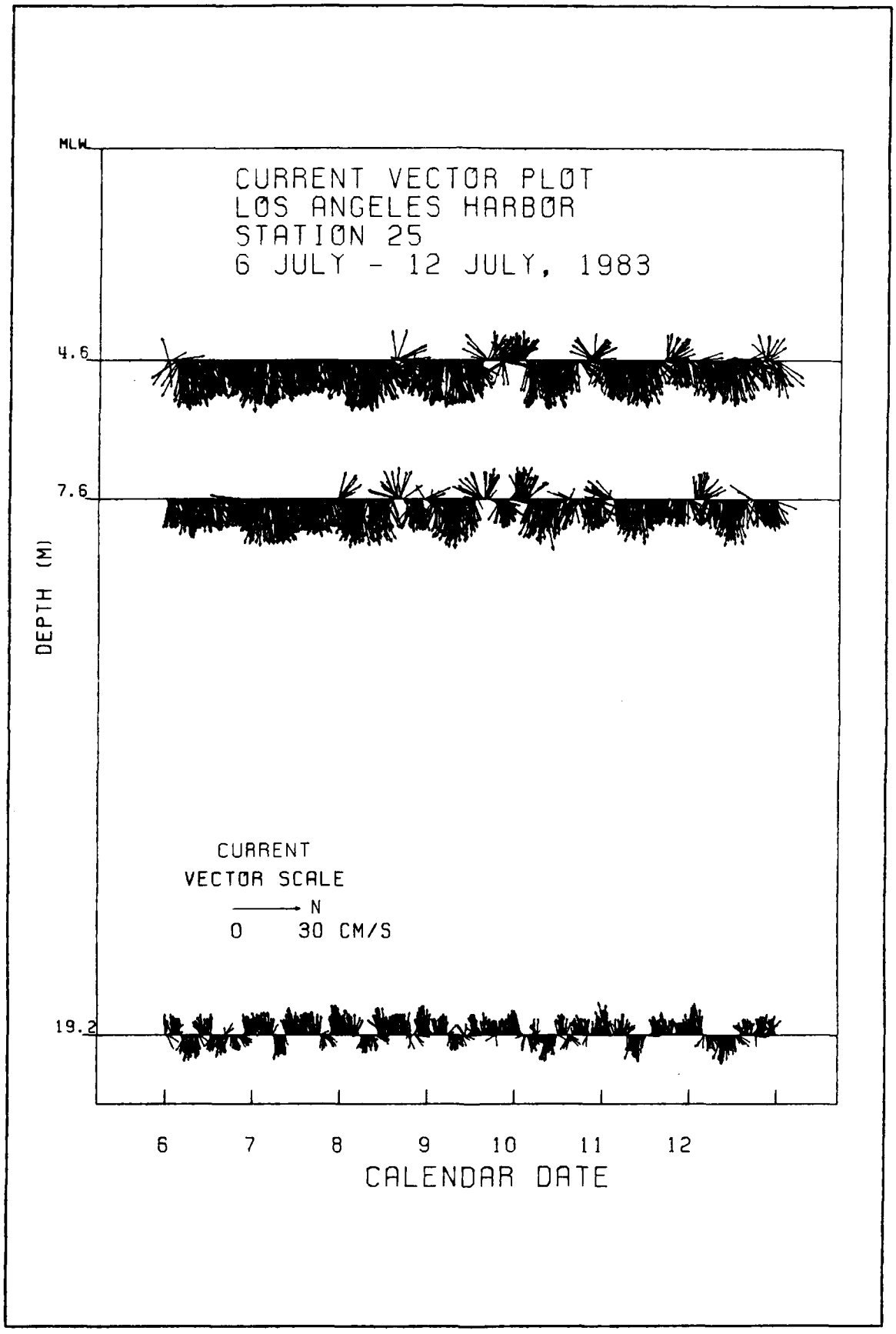

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 24
21 JULY - 27 JULY, 1983
MLW
4.9
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
21 22 23 24 25 26 27
CALENDAR DATE

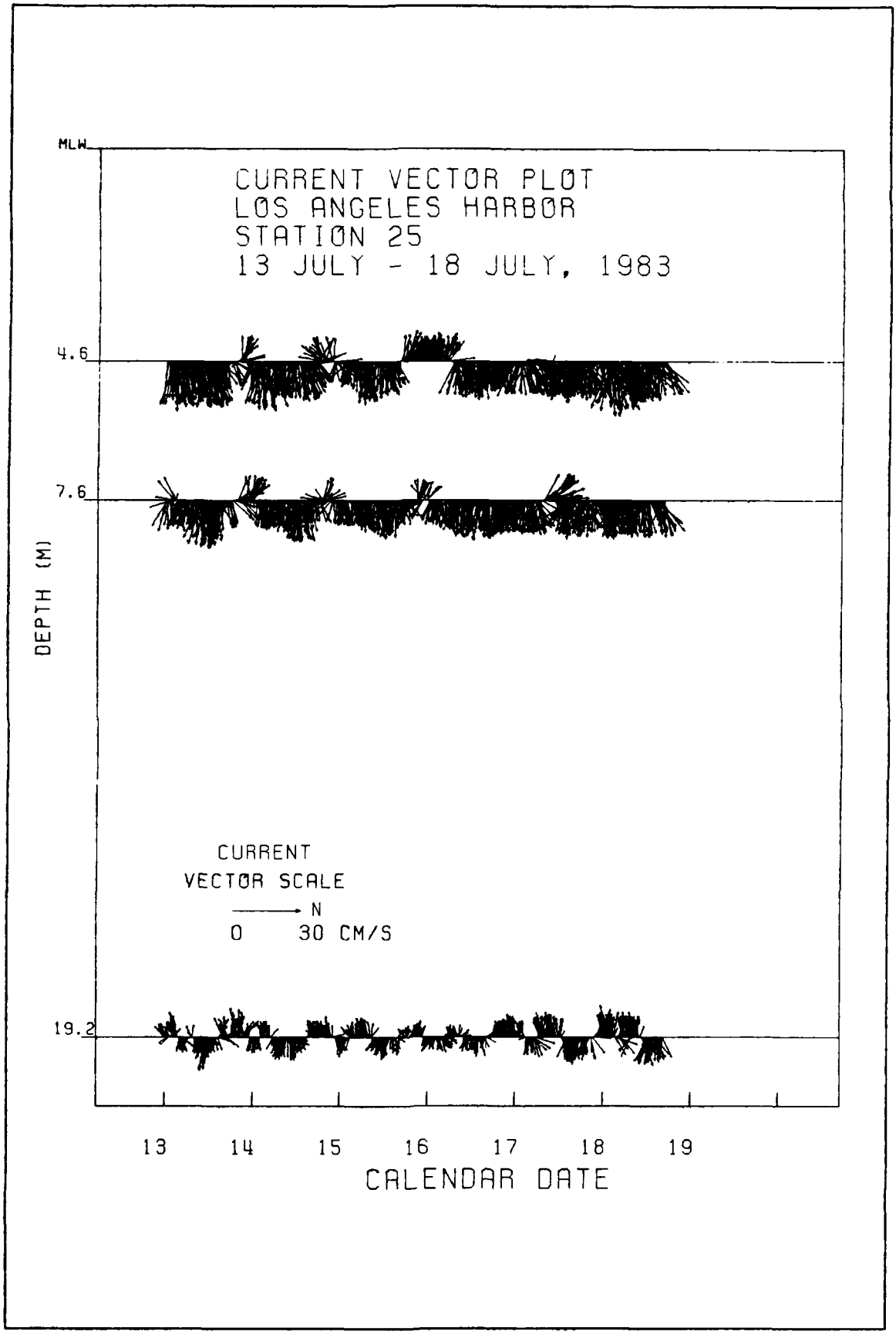

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 24
28 JULY - 3 AUGUST, 1983
MLW
4.9
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
28 29 30 31 1 2 3
CALENDAR DATE

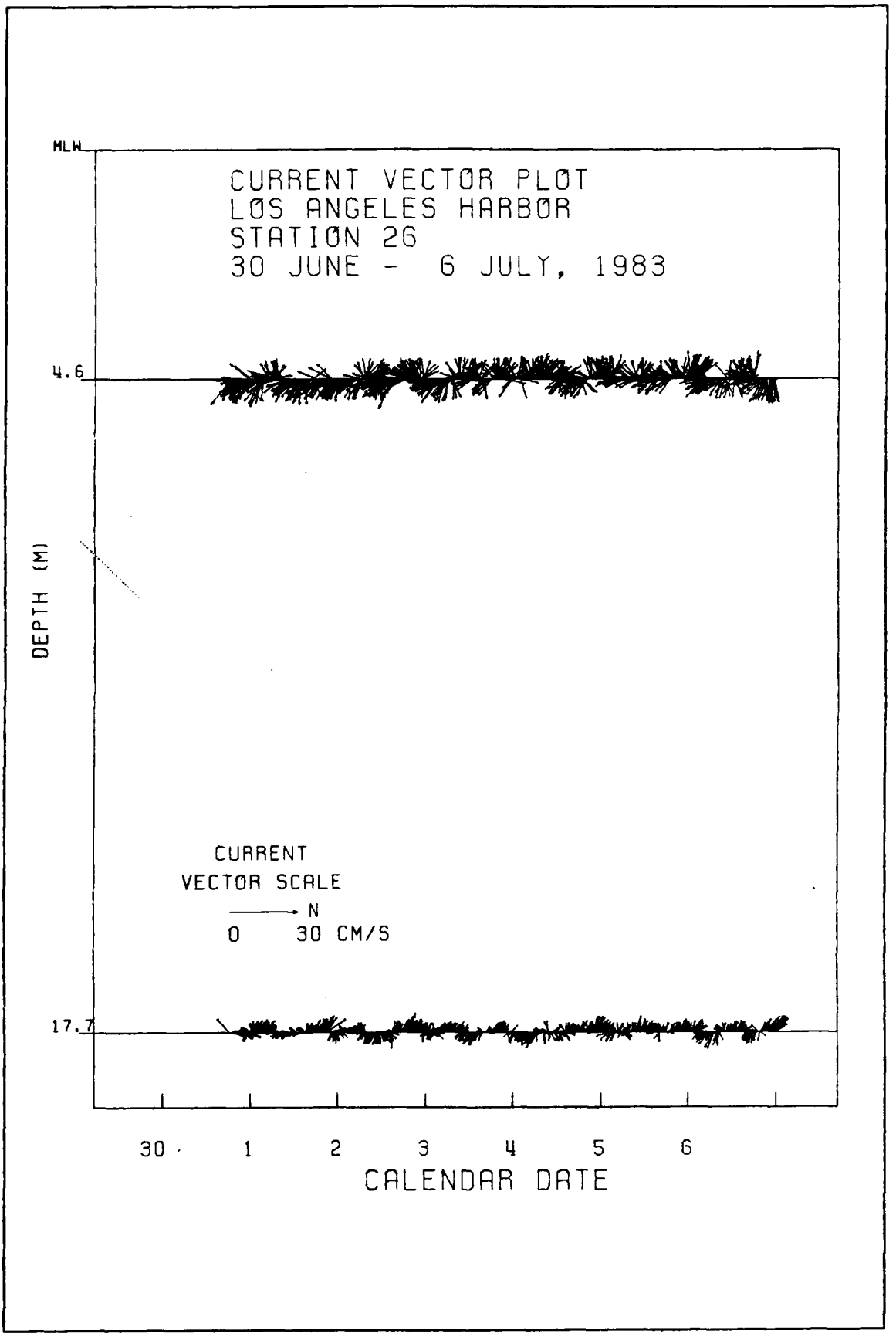

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 25
15 JUNE - 21 JUNE, 1983
4.6
7.6
19.2
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
15 16 17 18 19 20 21
CALENDAR DATE

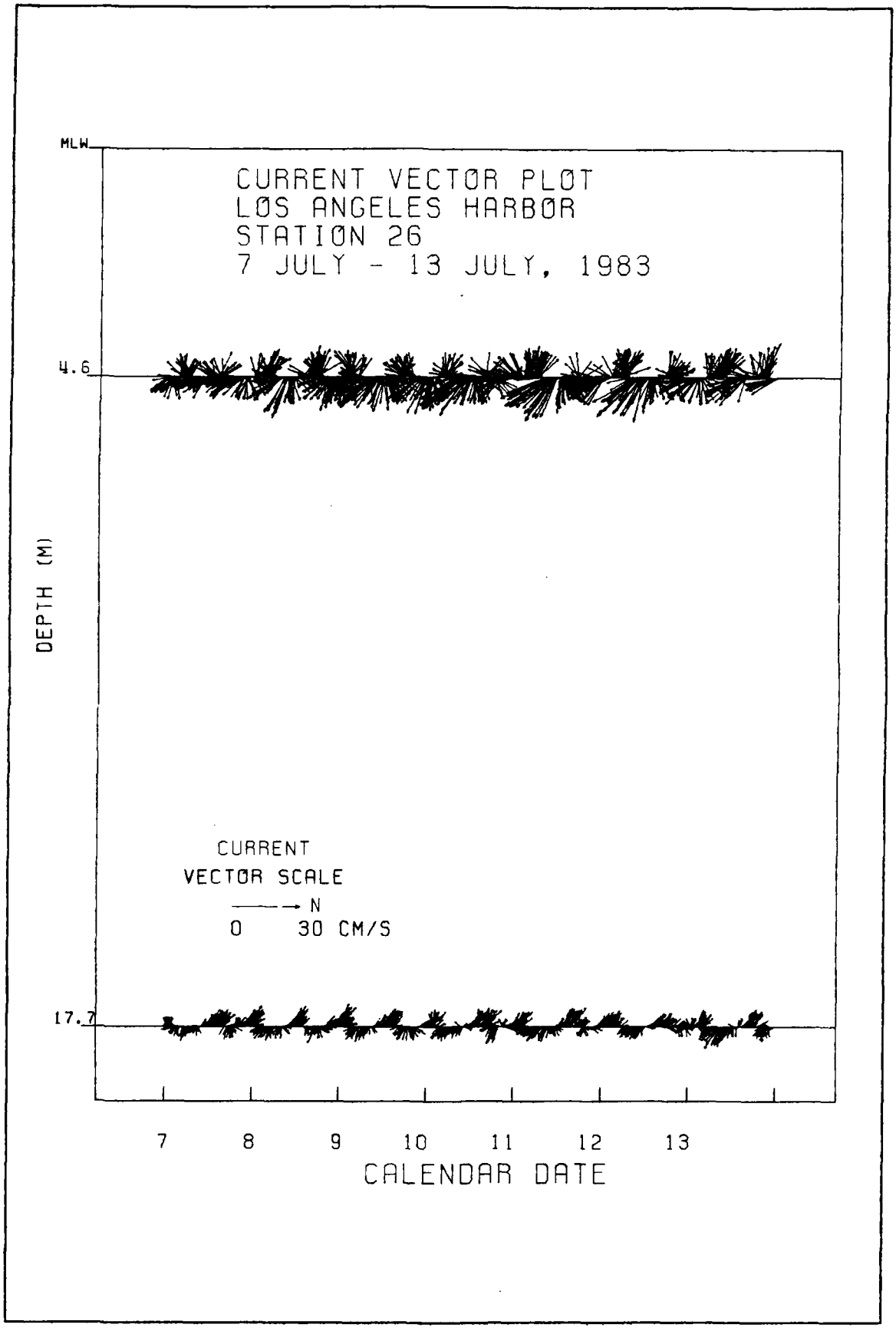

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 25
22 JUNE - 28 JUNE, 1983
MLW
4.6
7.6
19.2
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
22
23
24
25
26
27
28
CALENDAR DATE

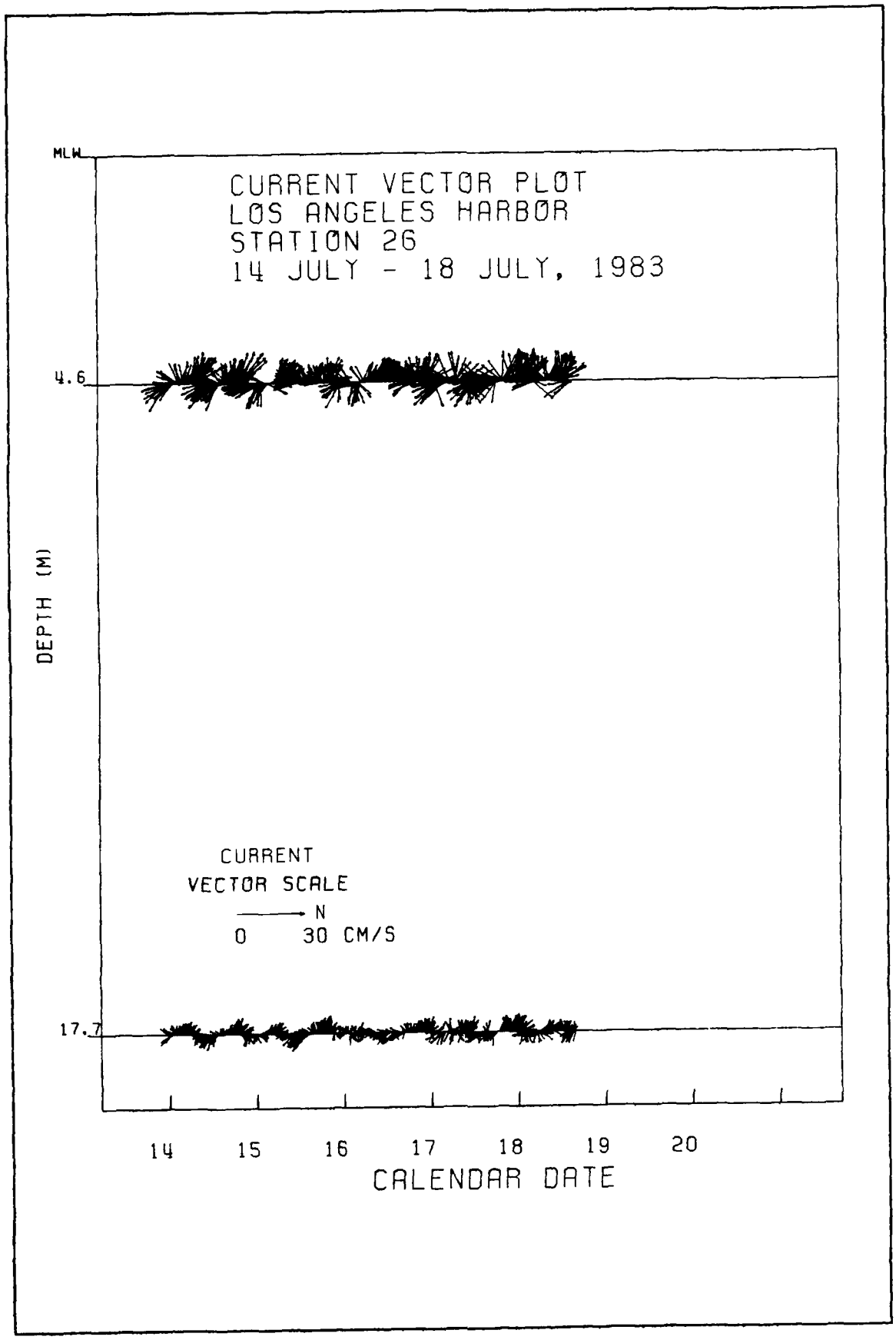

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 25
29 JUNE - 5 JULY, 1983
4.6
7.6
19.2
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
29 30 1 2 3 4 5
CALENDAR DATE

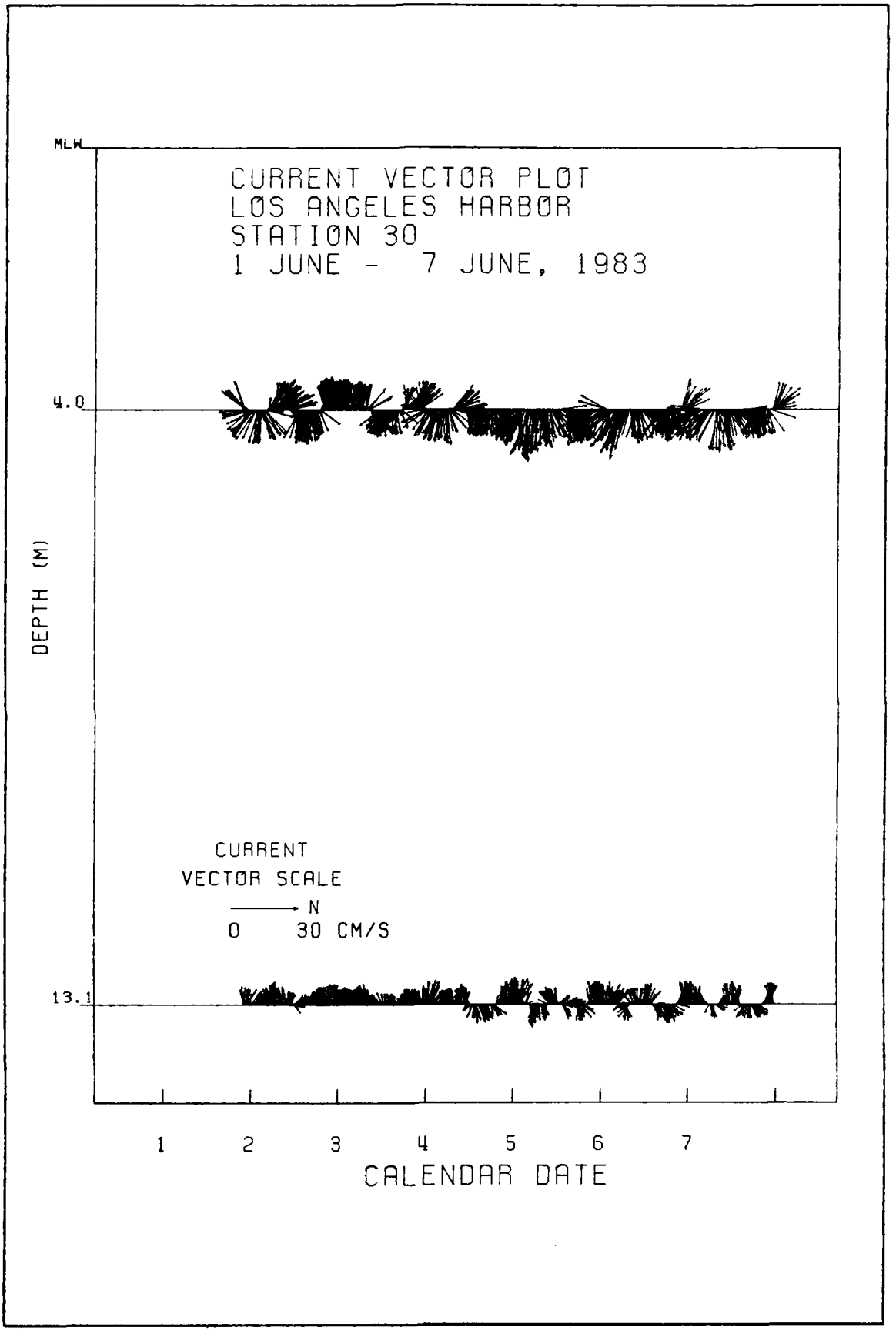

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 25
6 JULY - 12 JULY, 1983
4.6
7.6
19.2
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
6
7
8
9
10
11
12
CALENDAR DATE

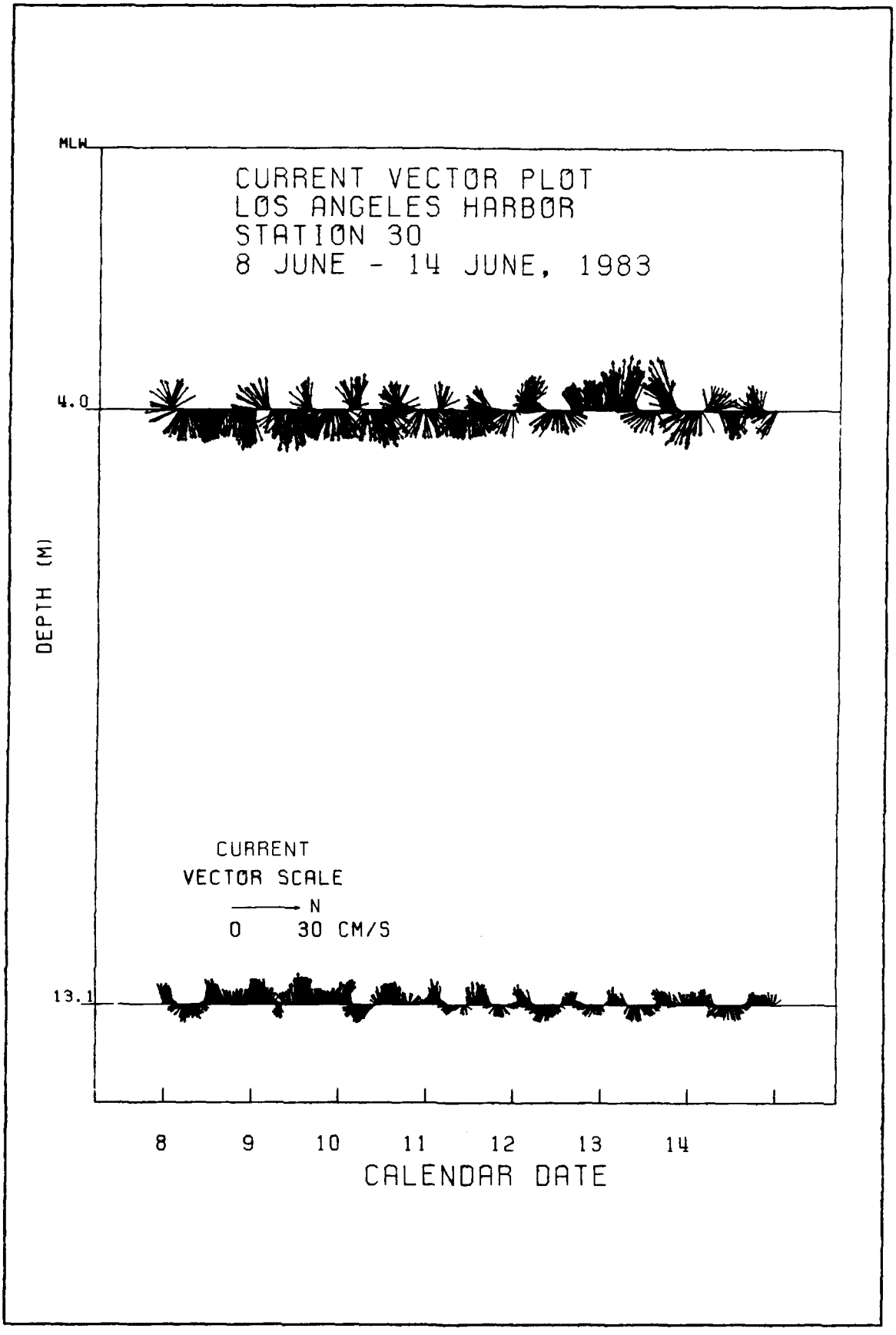

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 25
13 JULY - 18 JULY, 1983
MLW
4.6
7.6
19.2
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
13
14
15
16
17
18
19
CALENDAR DATE

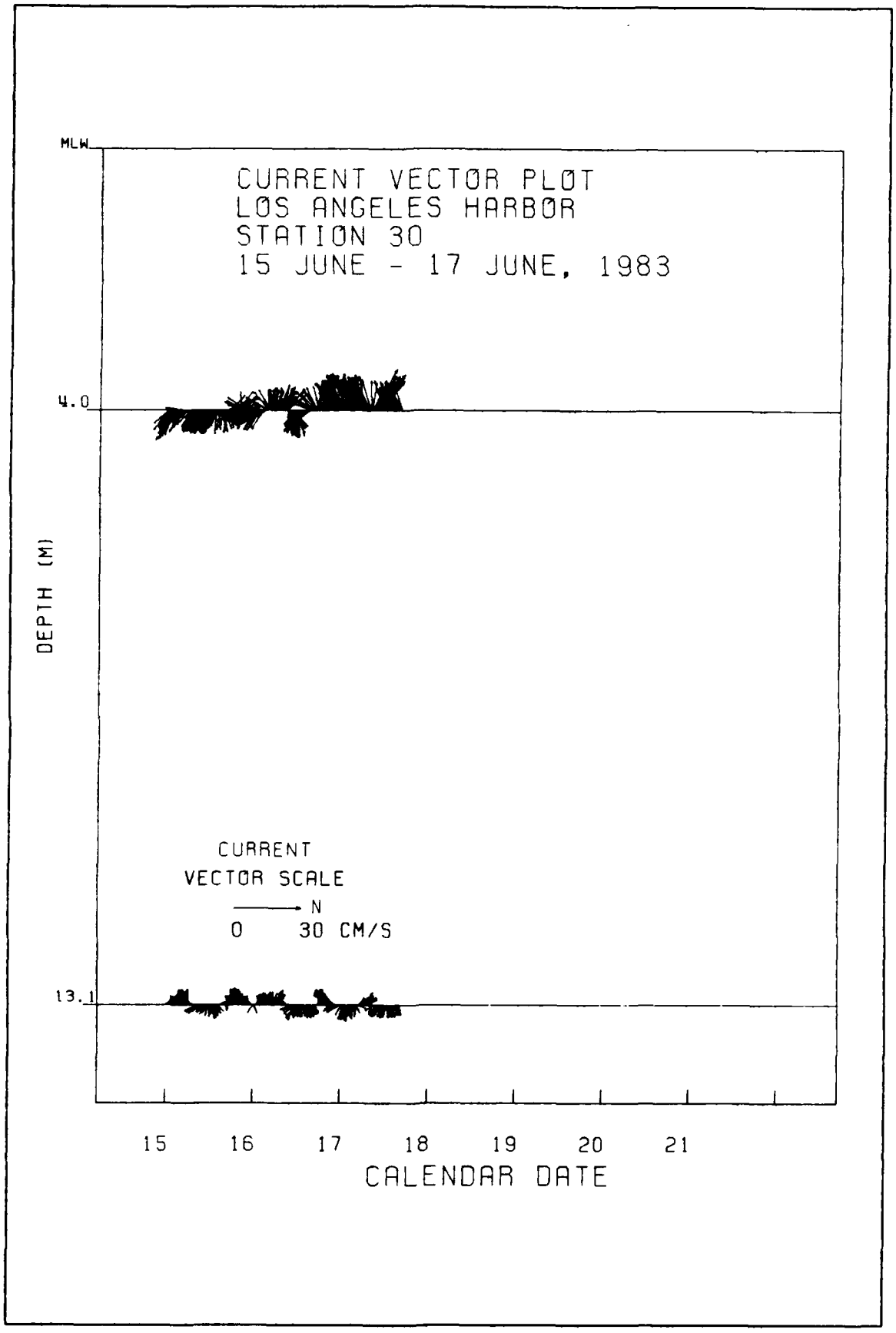

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 26
30 JUNE - 6 JULY, 1983
4.6
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
17.7
30
1
2
3
4
5
6
CALENDAR DATE

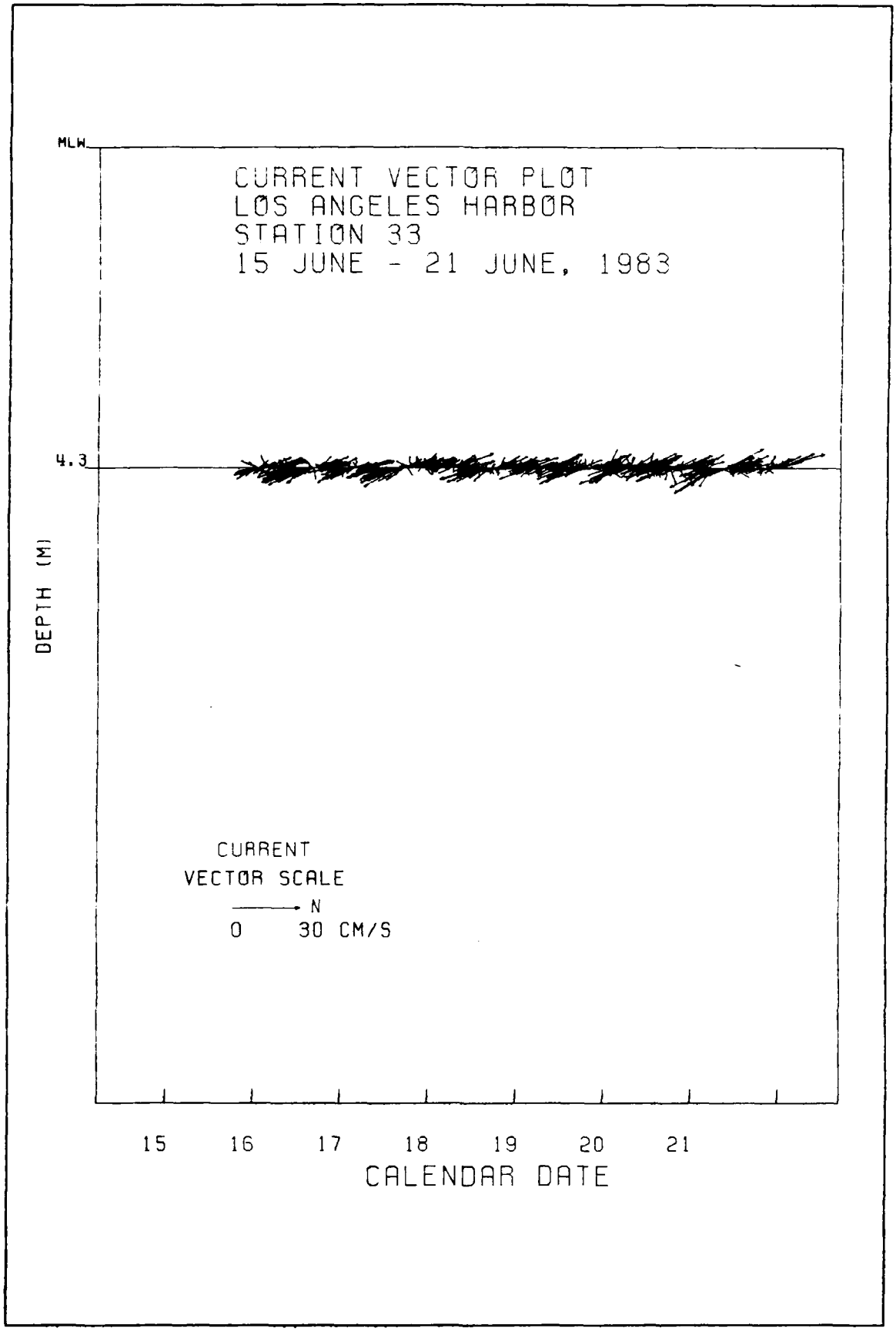

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 26
7 JULY - 13 JULY, 1983
4.6
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
17.7
7 8 9 10 11 12 13
CALENDAR DATE

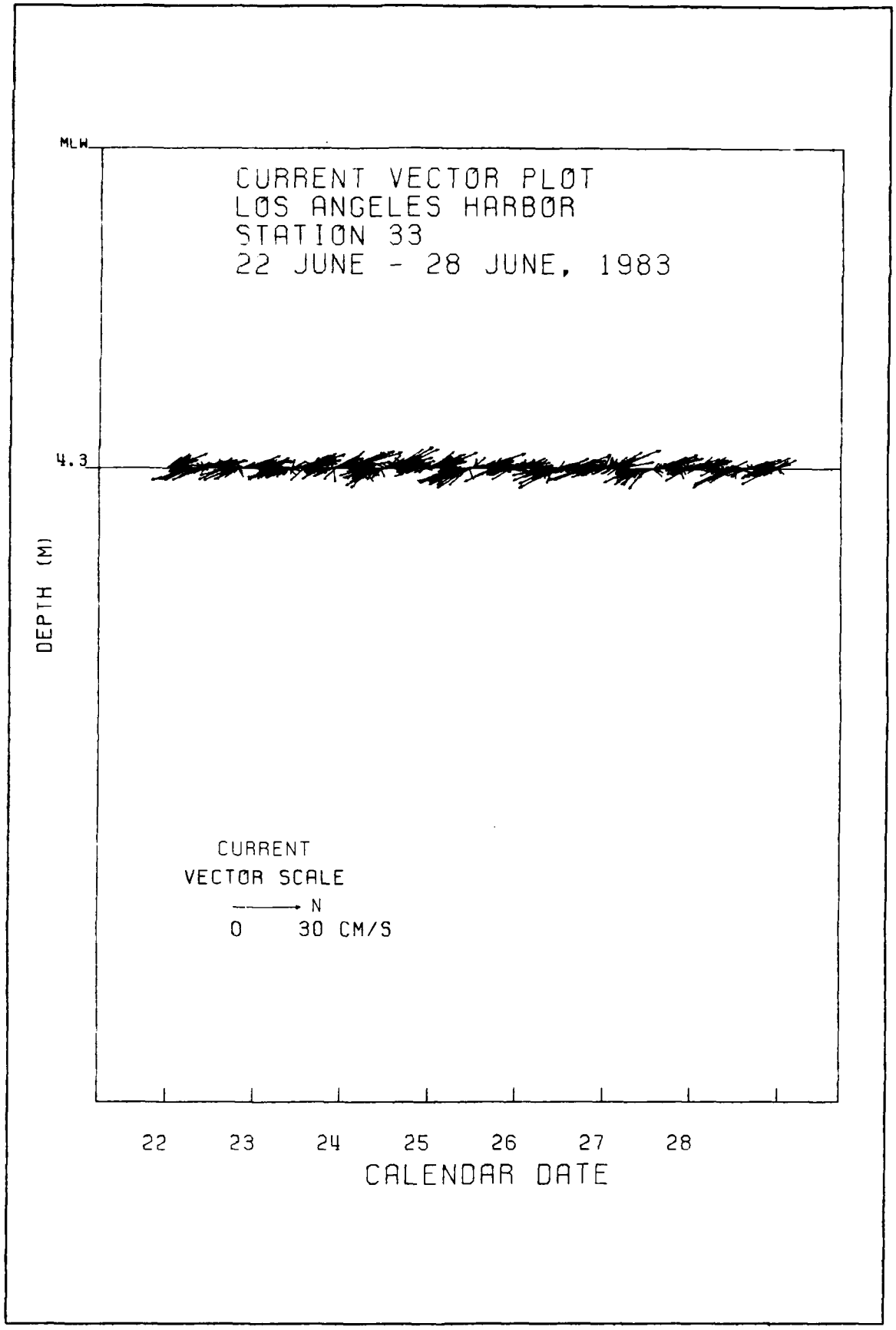

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 26
14 JULY - 18 JULY, 1983
4.6
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
17.7
14 15 16 17 18 19 20
CALENDAR DATE

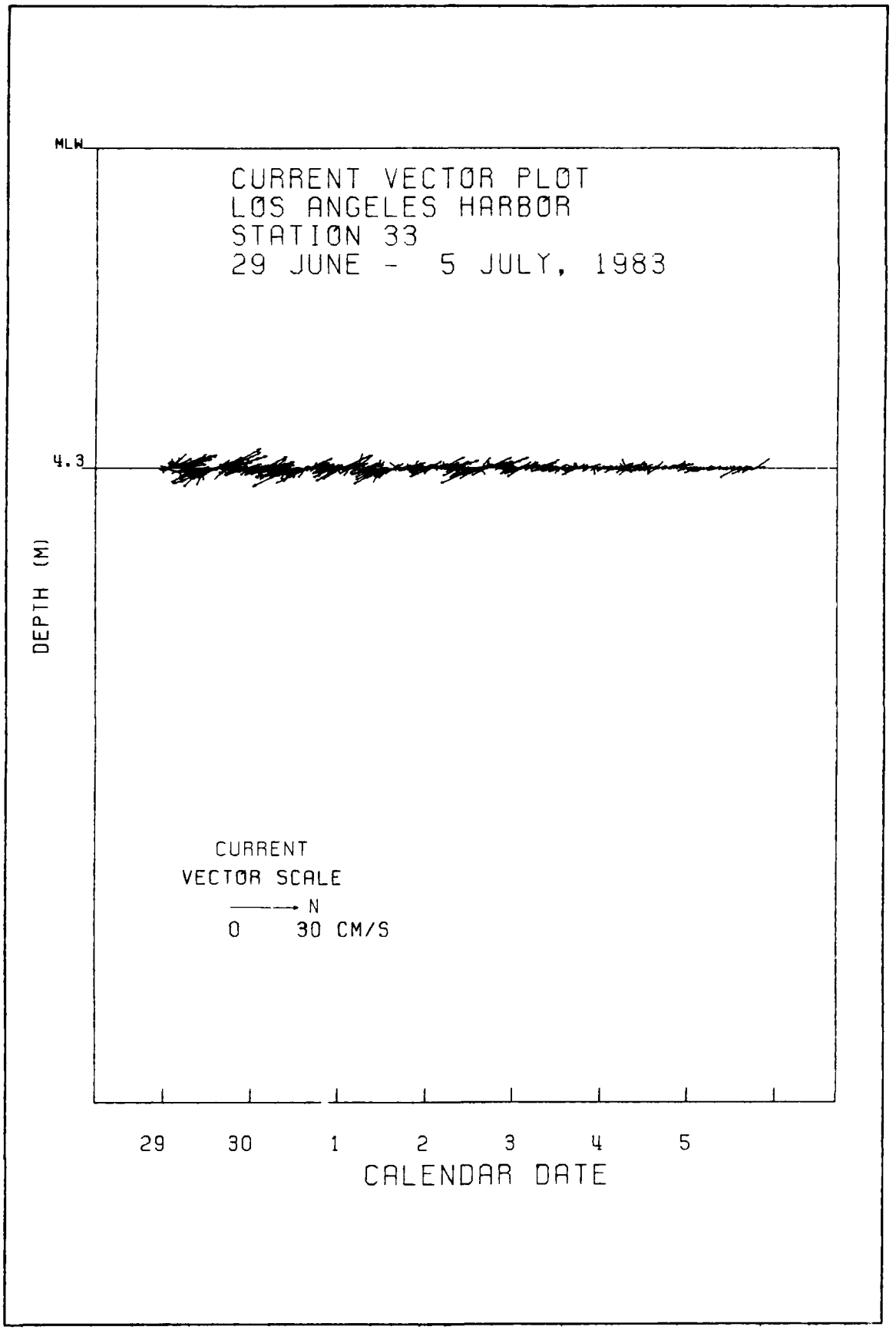

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 30
1 JUNE - 7 JUNE, 1983
MLW
4.0
13.1
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
1
2
3
4
5
6
7
CALENDAR DATE

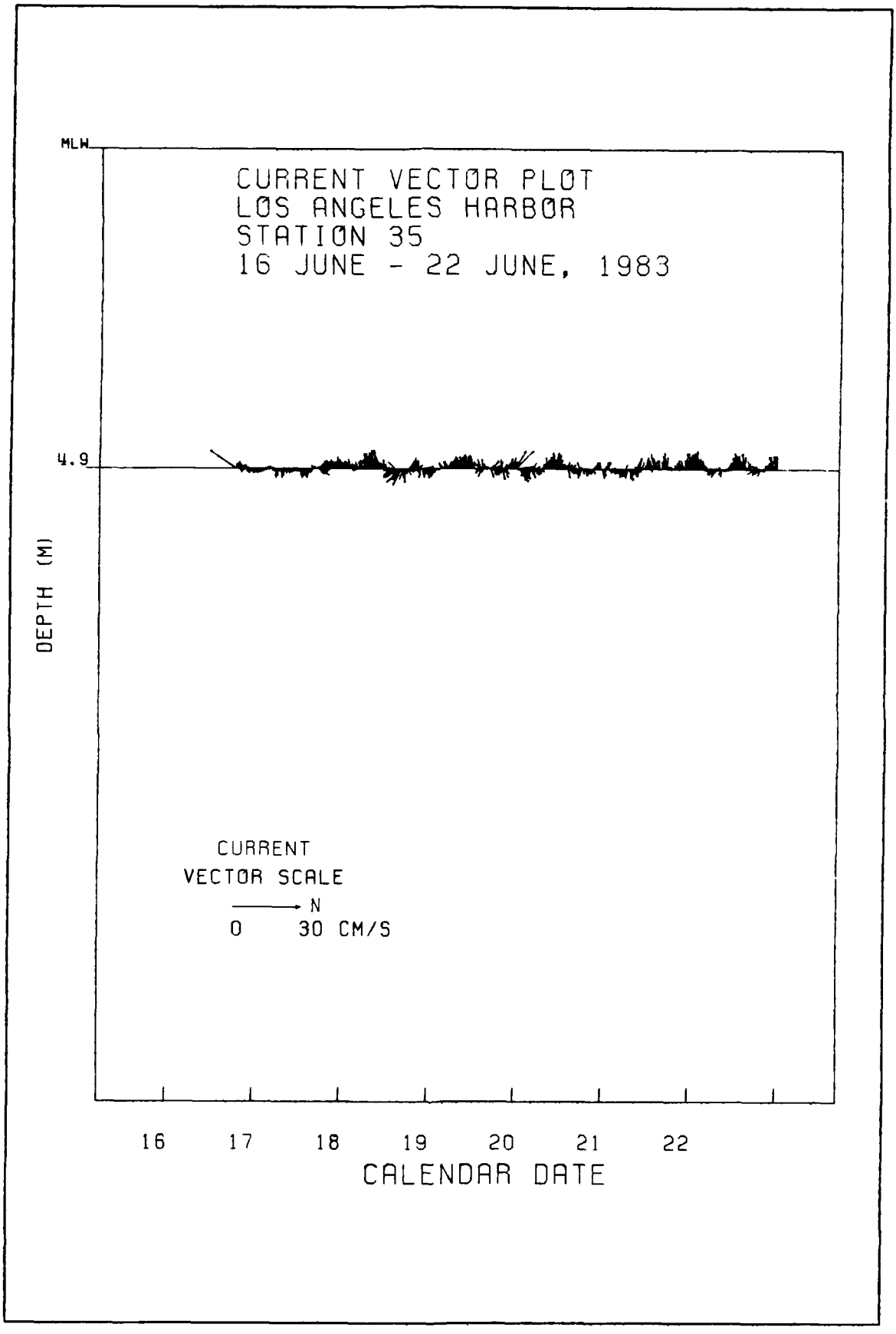

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 30
8 JUNE - 14 JUNE, 1983
MLW
4.0
13.1
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
8
9
10
11
12
13
14
CALENDAR DATE

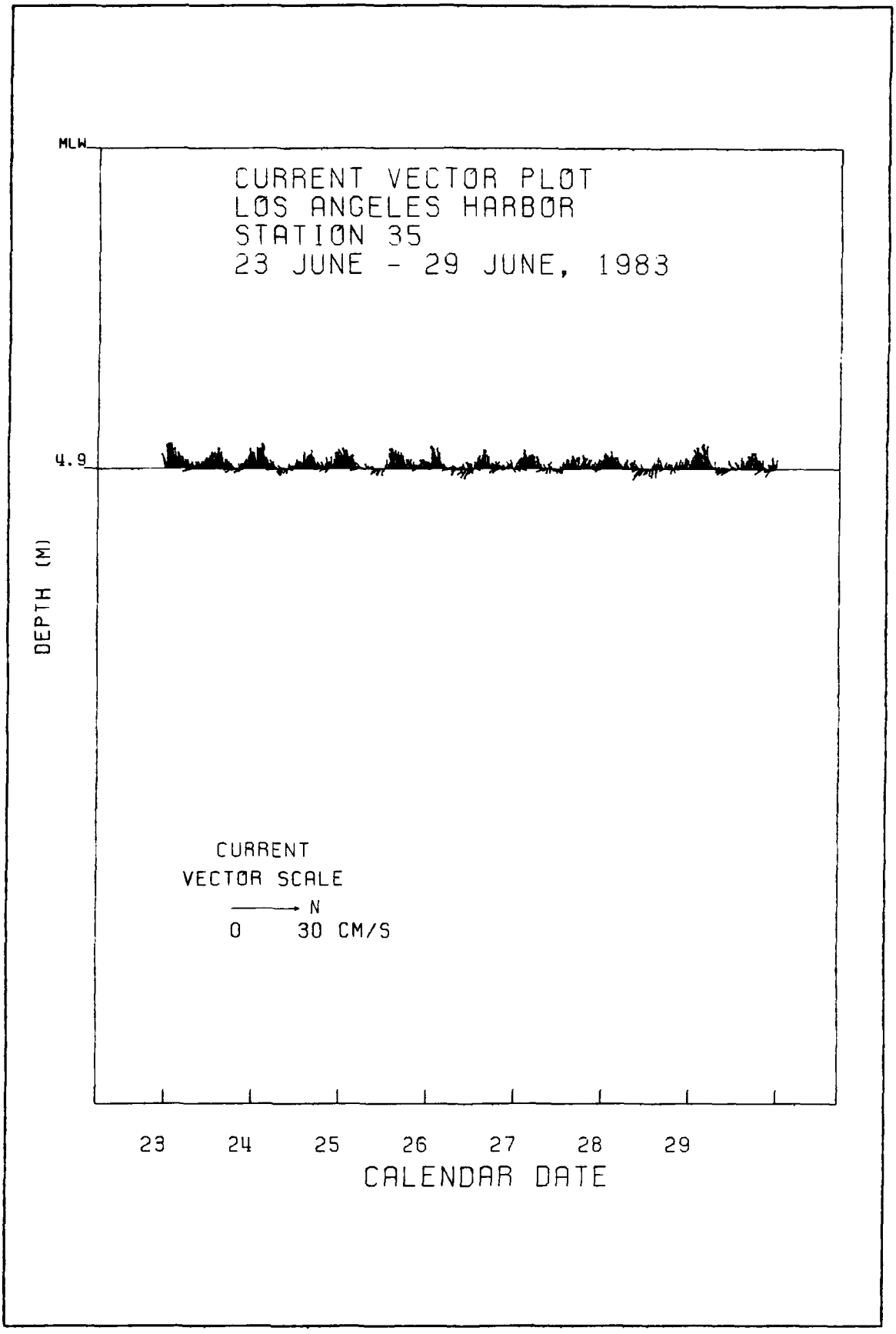

CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 30
15 JUNE - 17 JUNE, 1983
MLW
4.0
13.1
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
15 16 17 18 19 20 21
CALENDAR DATE

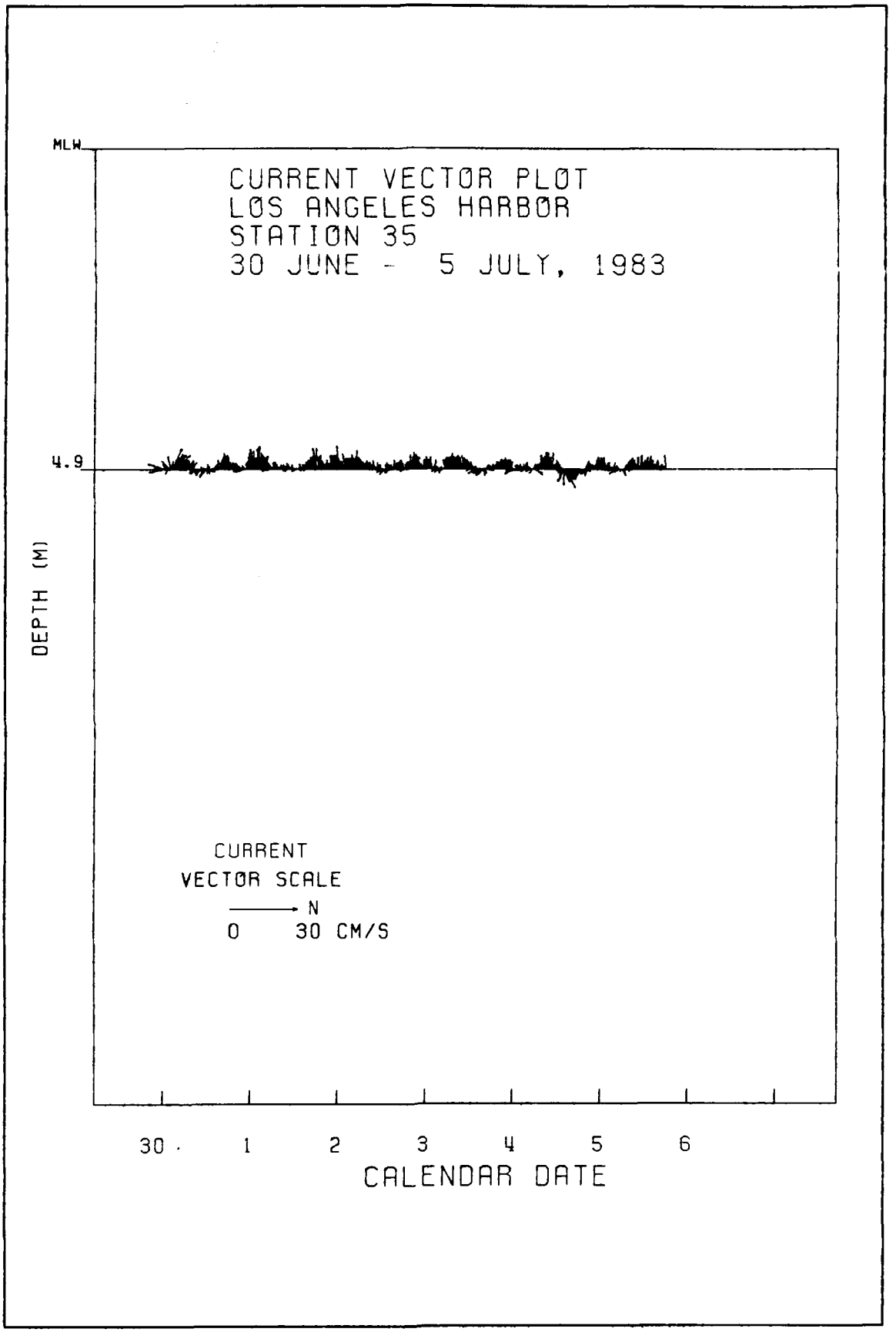

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 33
15 JUNE - 21 JUNE, 1983
4.3
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
15 16 17 18 19 20 21
CALENDAR DATE


MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 33
22 JUNE - 28 JUNE, 1983
4.3
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
22 23 24 25 26 27 28
CALENDAR DATE

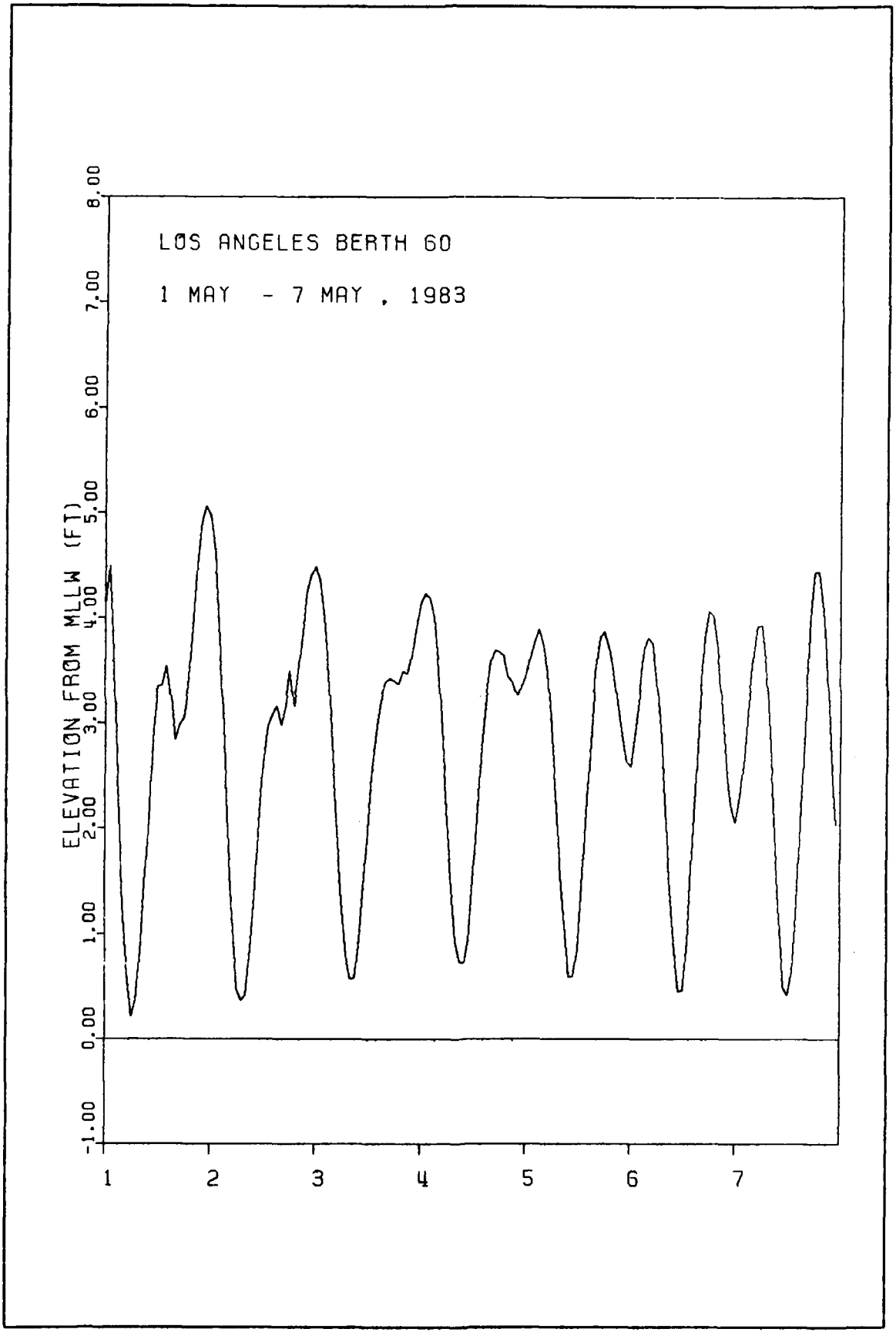

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 33
29 JUNE - 5 JULY, 1983
4.3
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
29 30 1 2 3 4 5
CALENDAR DATE

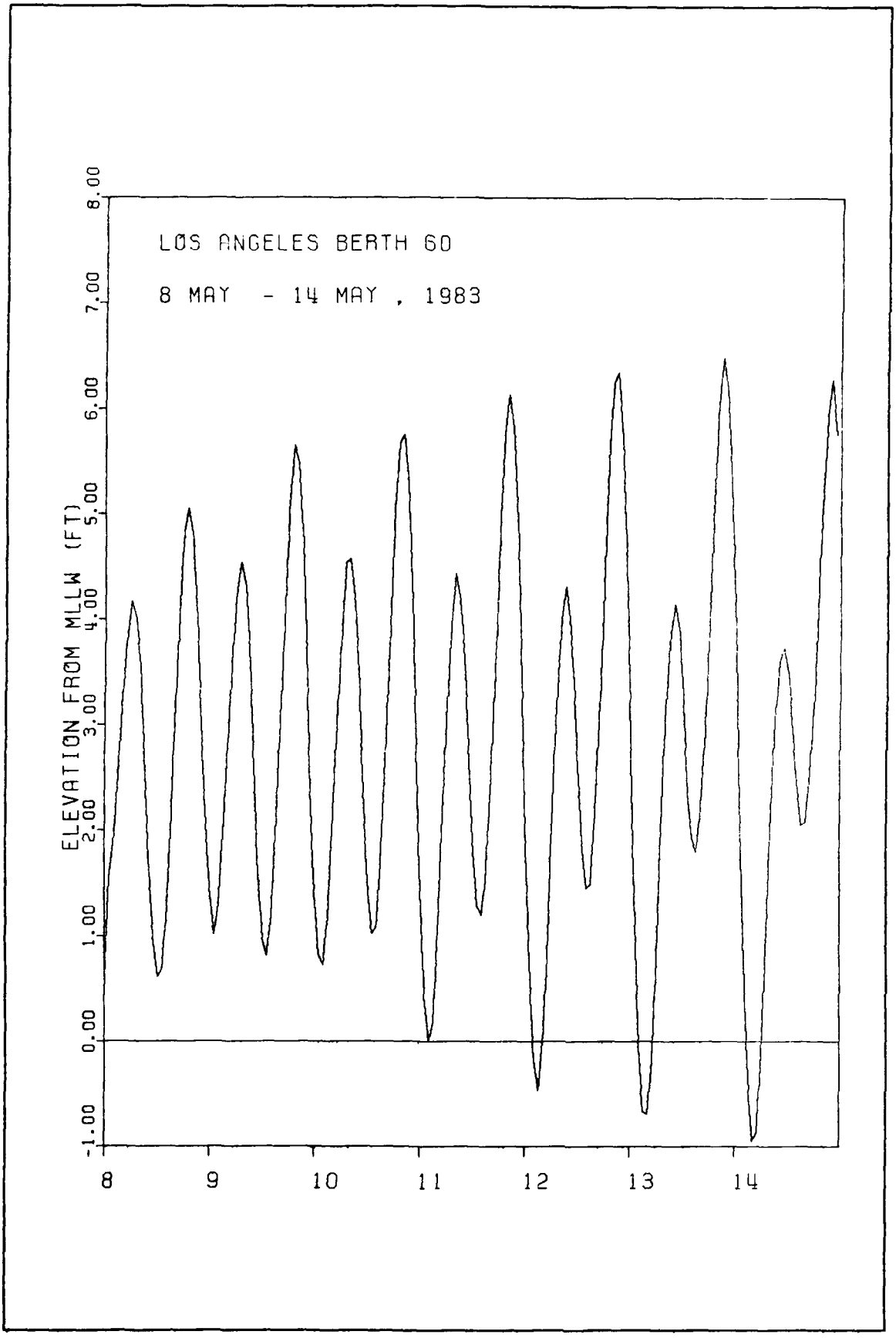

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 35
16 JUNE - 22 JUNE, 1983
4.9
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
16
17
18
19
20
21
22
CALENDAR DATE

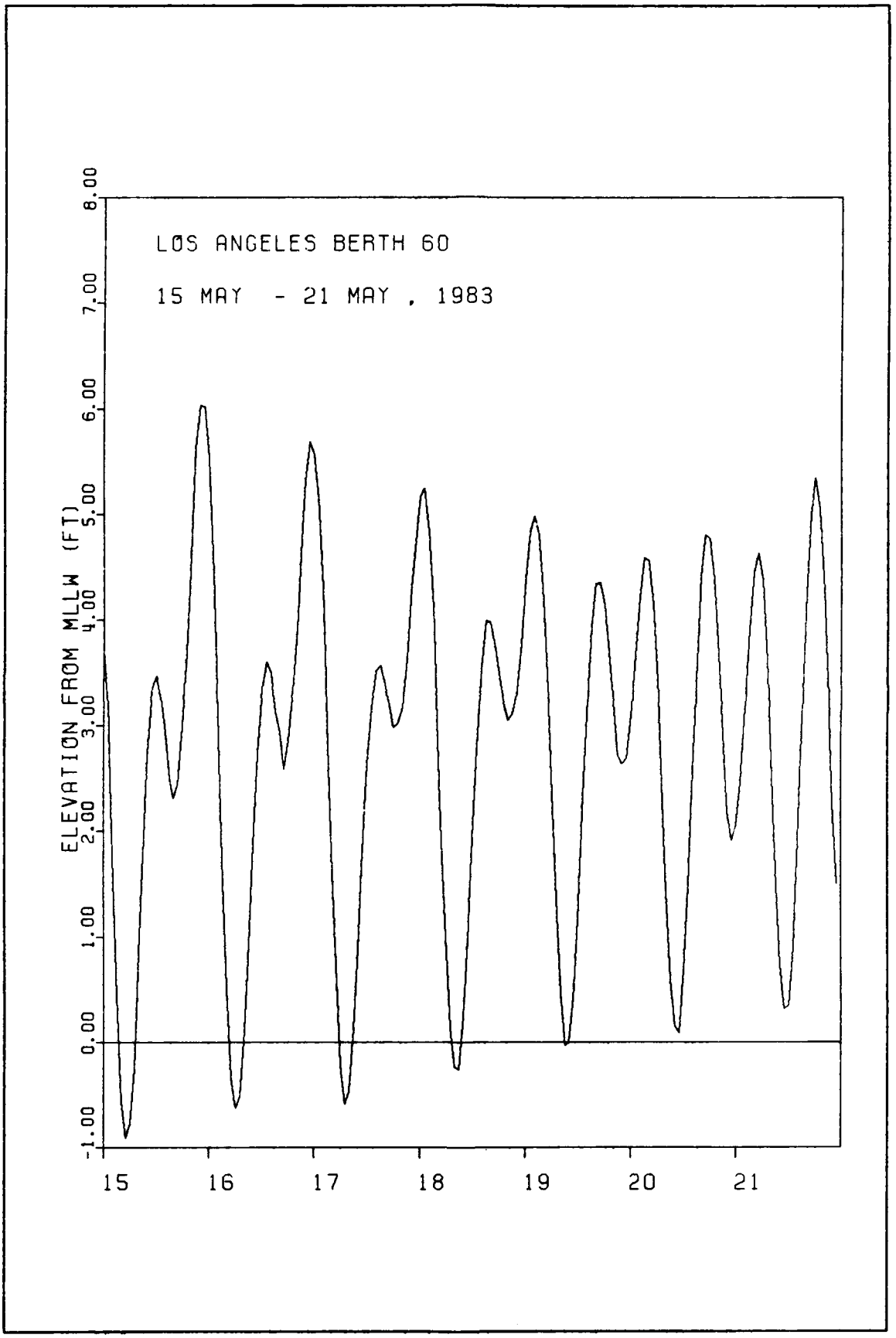

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 35
23 JUNE - 29 JUNE, 1983
4.9
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
23 24 25 26 27 28 29
CALENDAR DATE

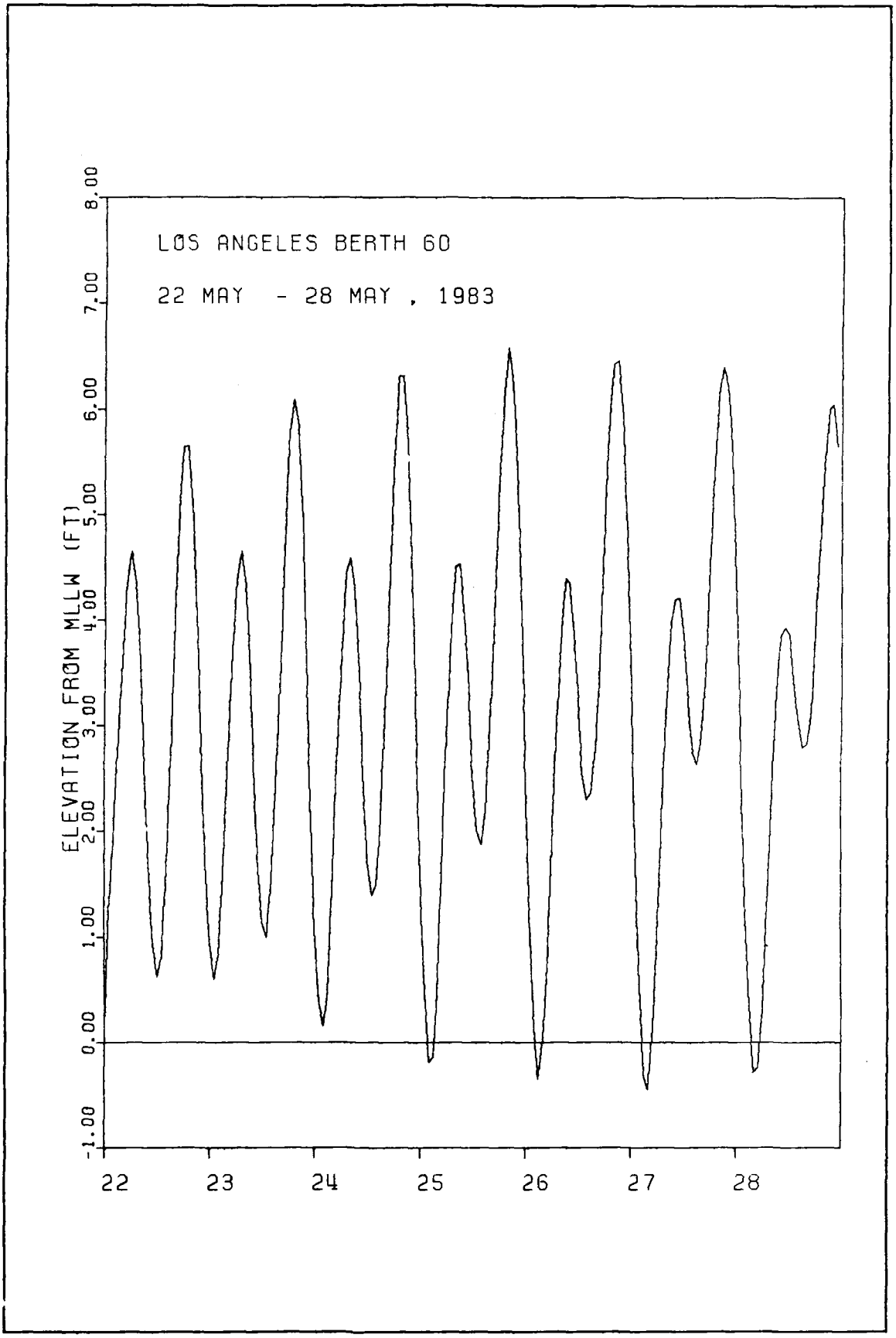

MLW
CURRENT VECTOR PLOT
LOS ANGELES HARBOR
STATION 35
30 JUNE - 5 JULY, 1983
4.9
DEPTH (M)
CURRENT
VECTOR SCALE
N
0 30 CM/S
30
1
2
3
4
5
6
CALENDAR DATE

APPENDIX C: TIDE DATA


LOS ANGELES BERTH 60
1 MAY - 7 MAY , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
1
2
3
4
5
6
7


LOS ANGELES BERTH 60
8 MAY - 14 MAY , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
8
9
10
11
12
13
14


LOS ANGELES BERTH 60
15 MAY - 21 MAY , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
15
16
17
18
19
20
21


LOS ANGELES BERTH 60
22 MAY - 28 MAY , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
22
23
24
25
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27
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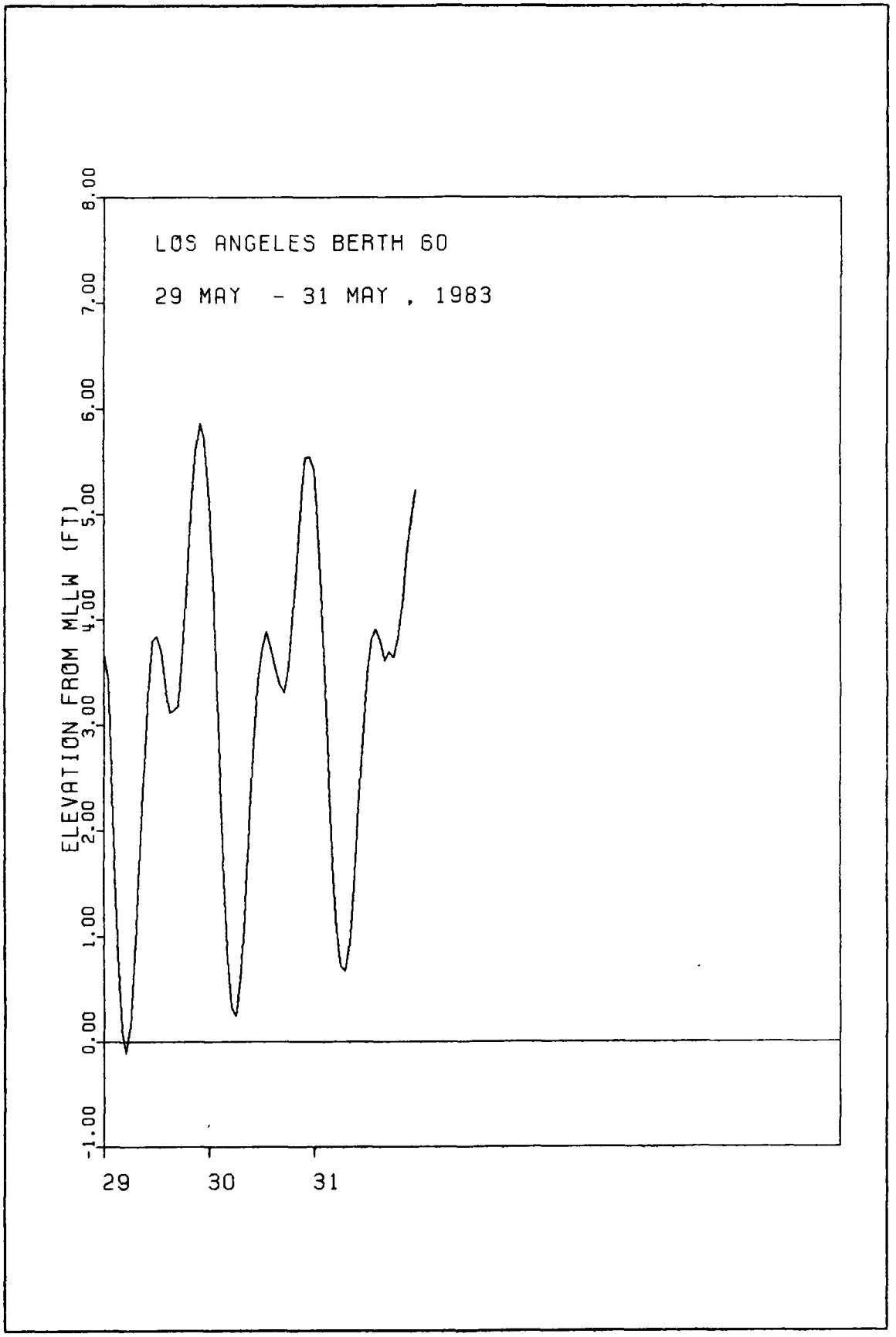
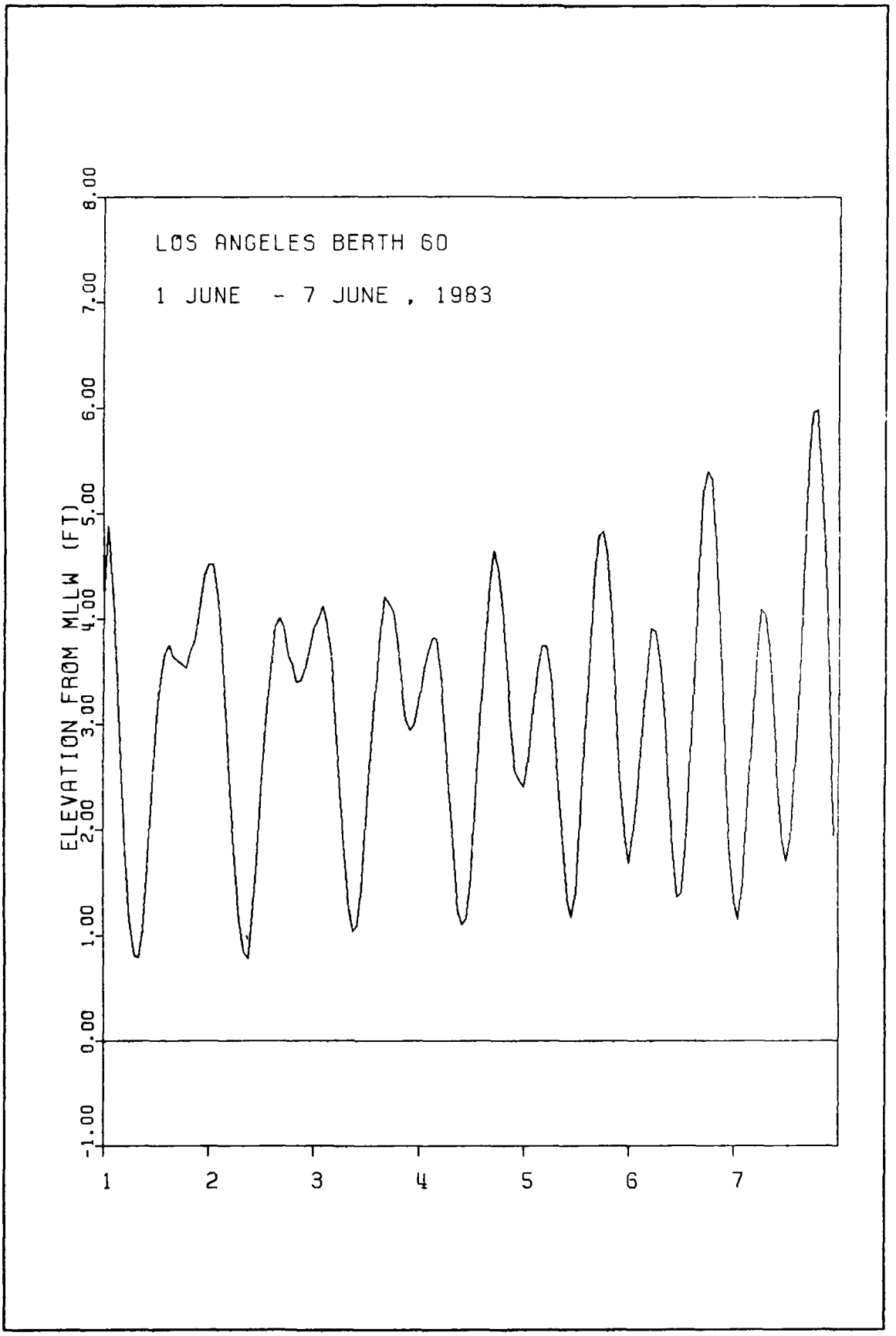
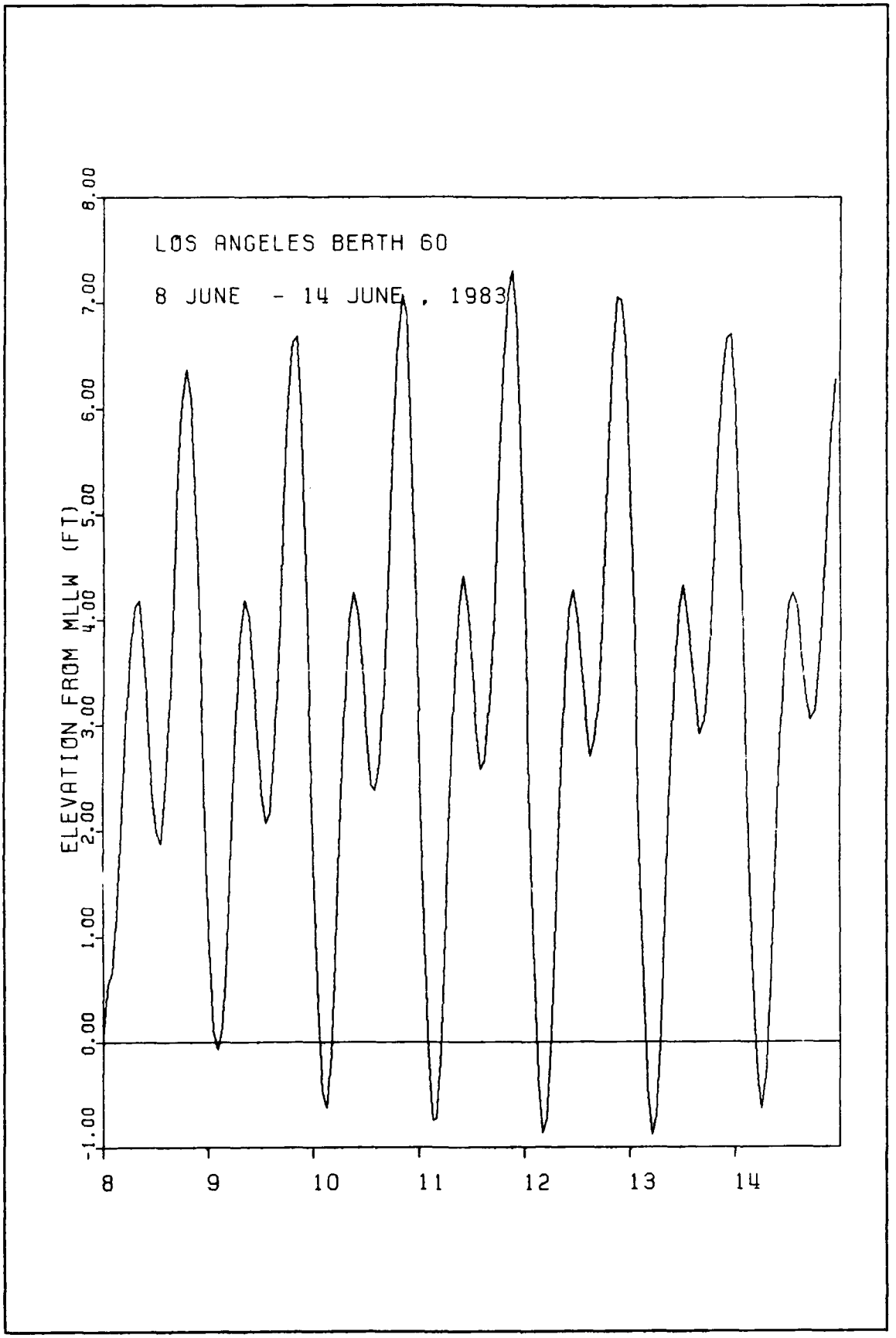
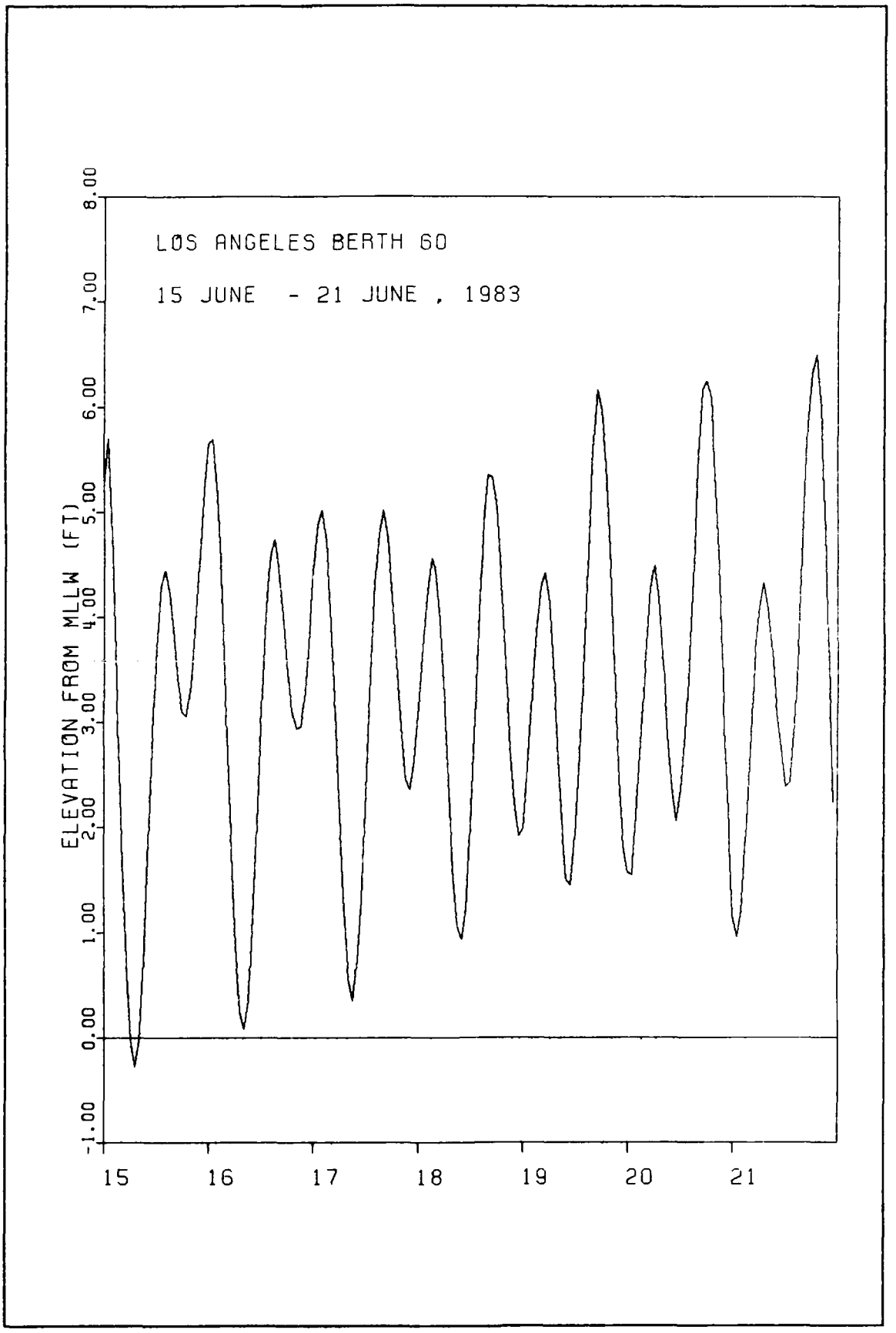
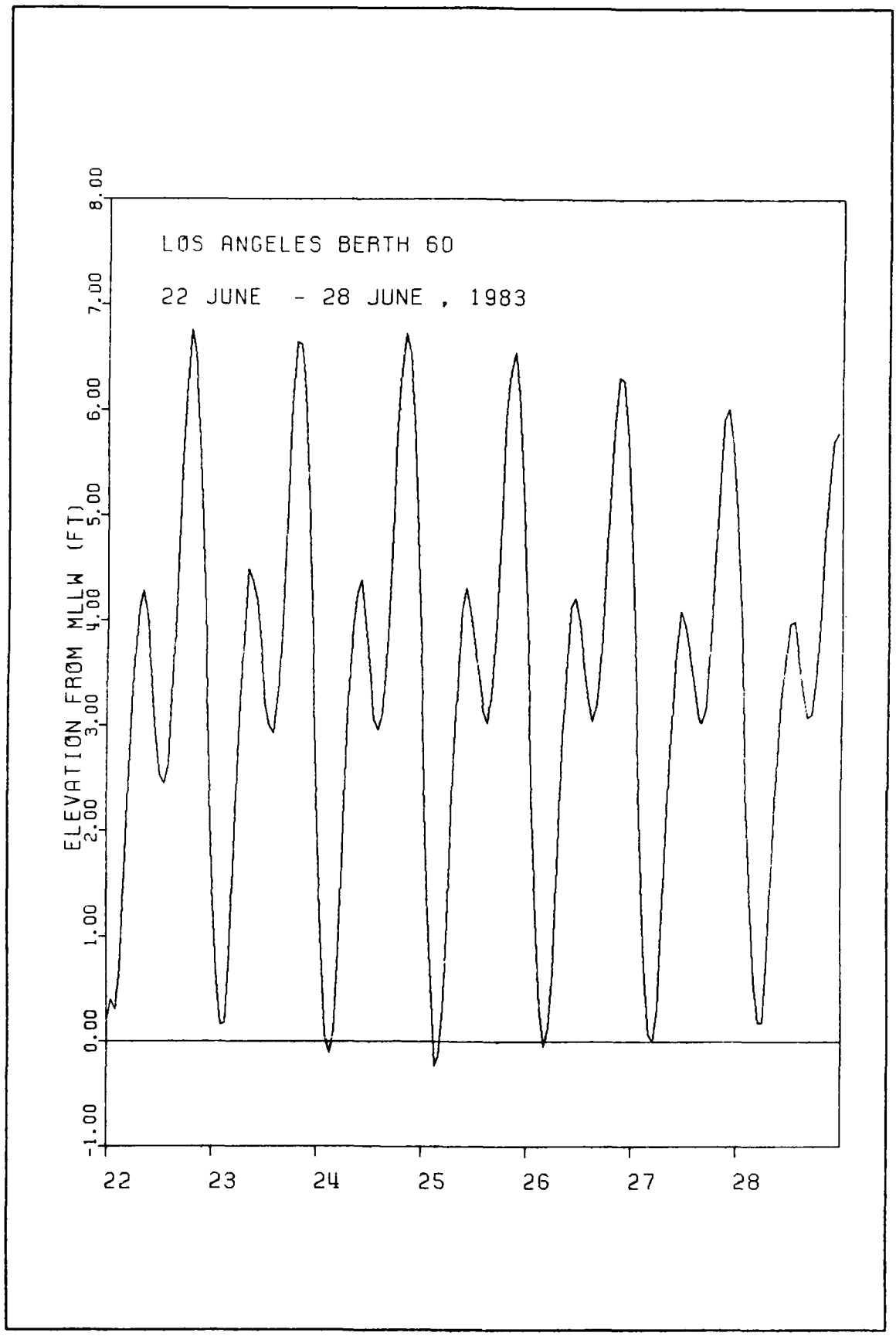
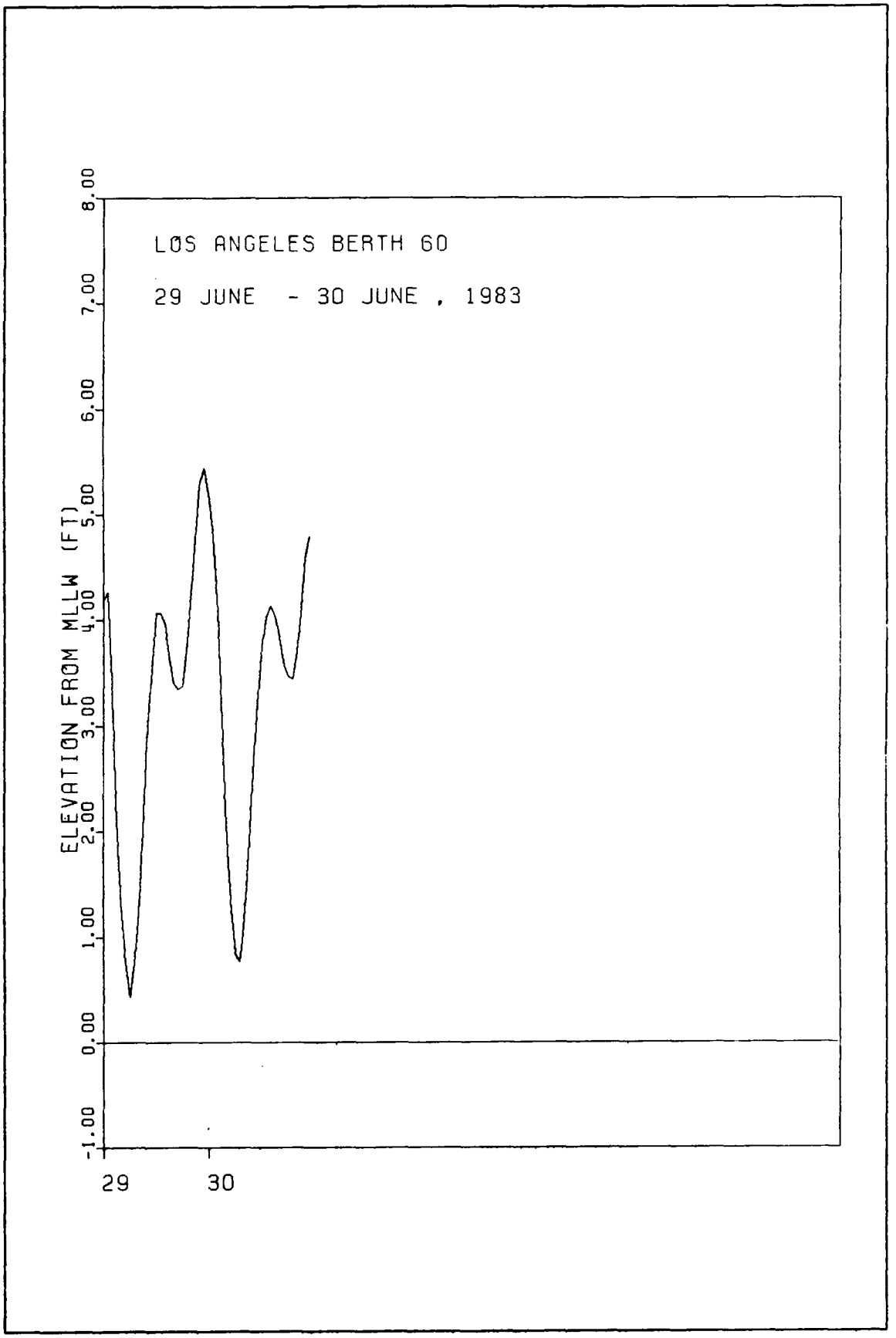

LOS ANGELES BERTH 60
29 MAY - 31 MAY , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
29
30
31

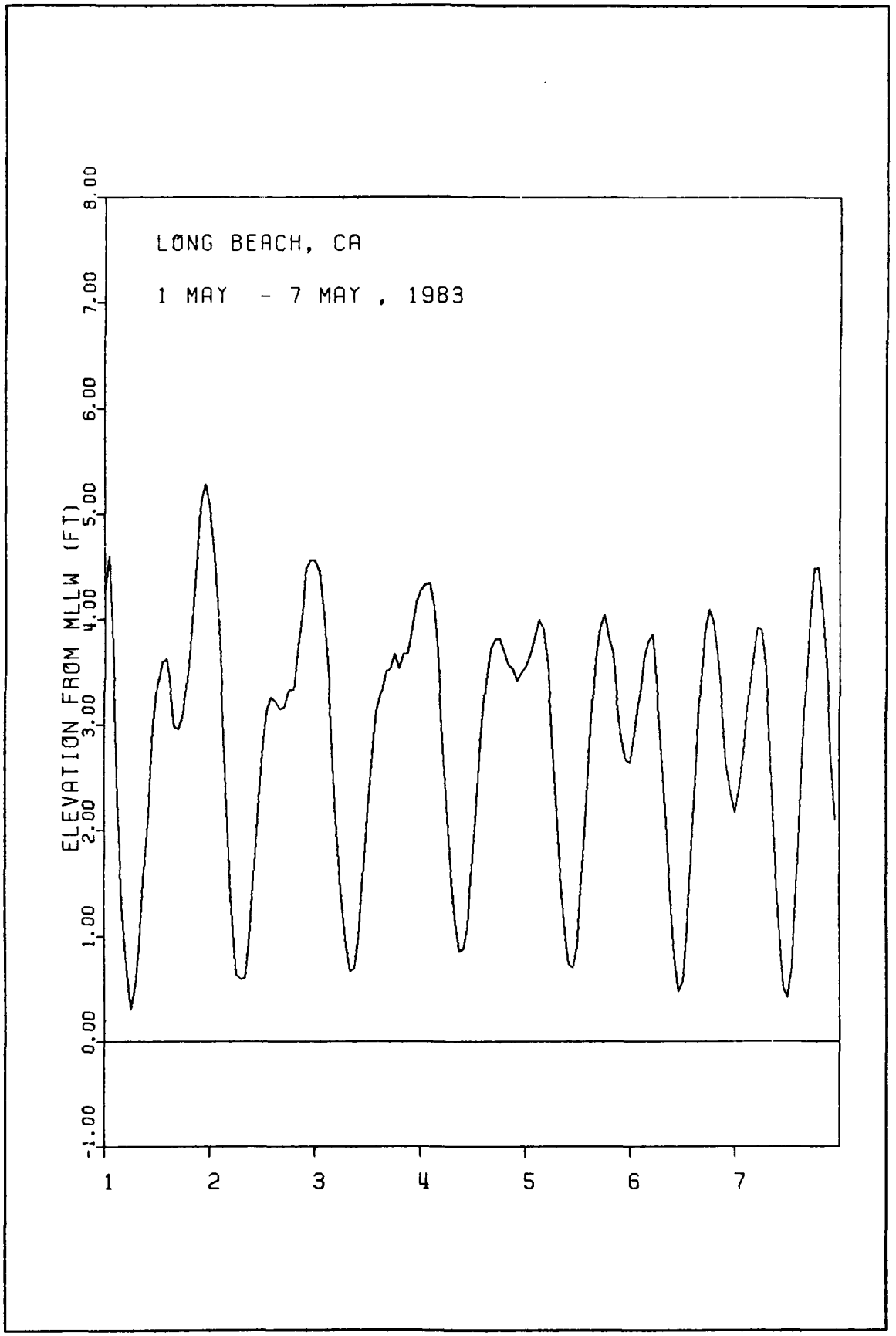

LOS ANGELES BERTH 60
1 JUNE - 7 JUNE , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
1
2
3
4
5
6
7

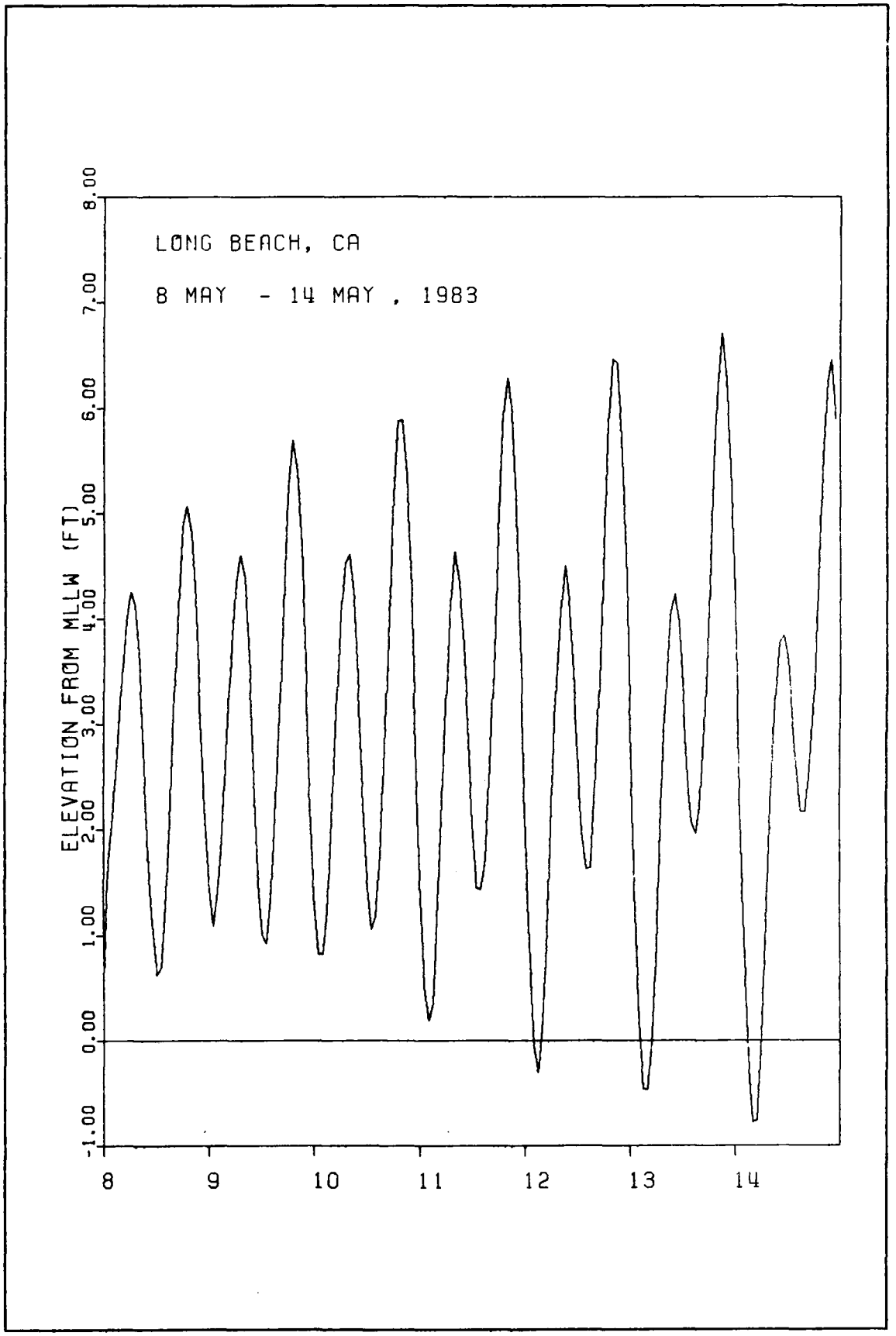

LOS ANGELES BERTH 60
8 JUNE - 14 JUNE , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
8
9
10
11
12
13
14

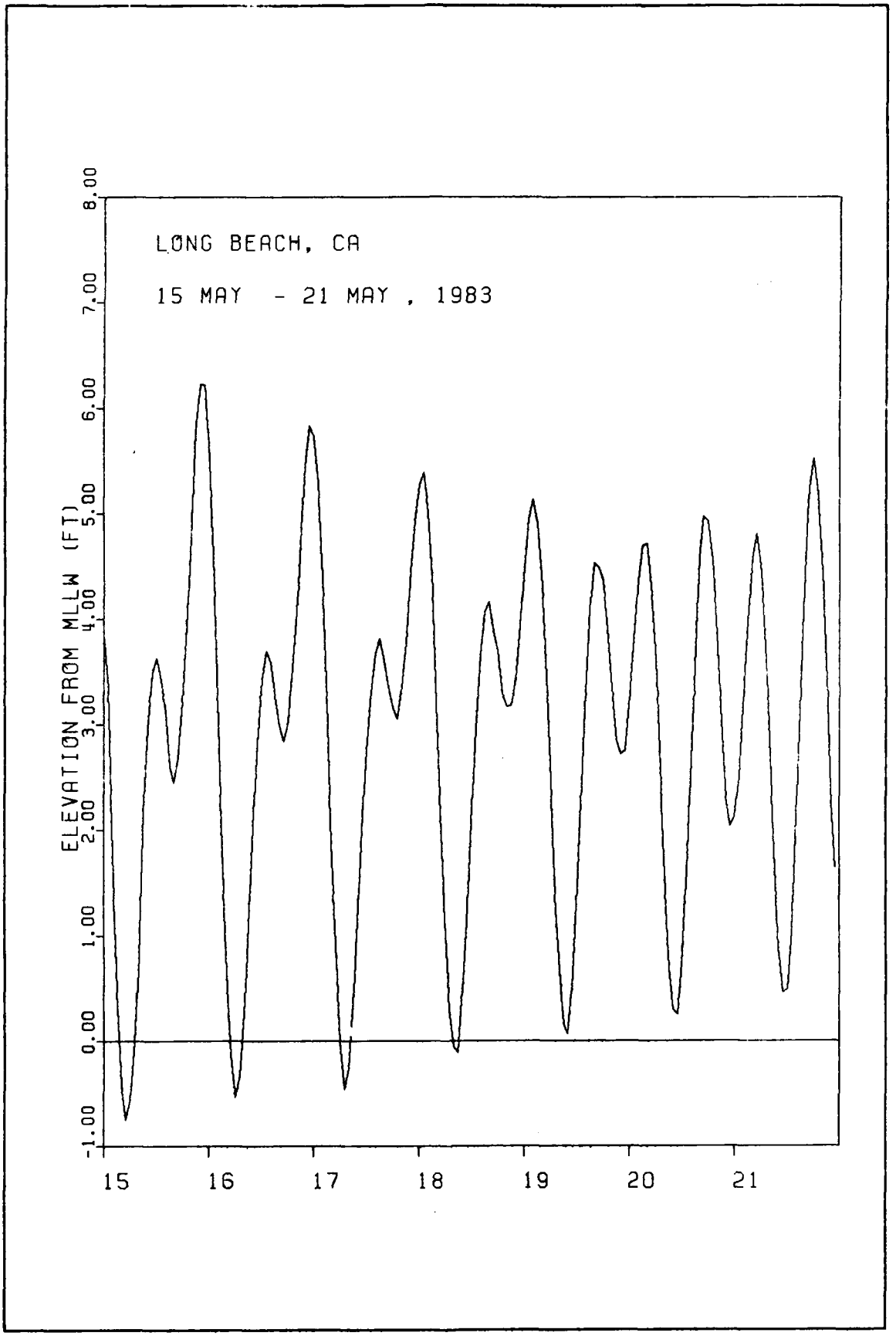

LOS ANGELES BERTH 60
15 JUNE - 21 JUNE , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
15
16
17
18
19
20
21

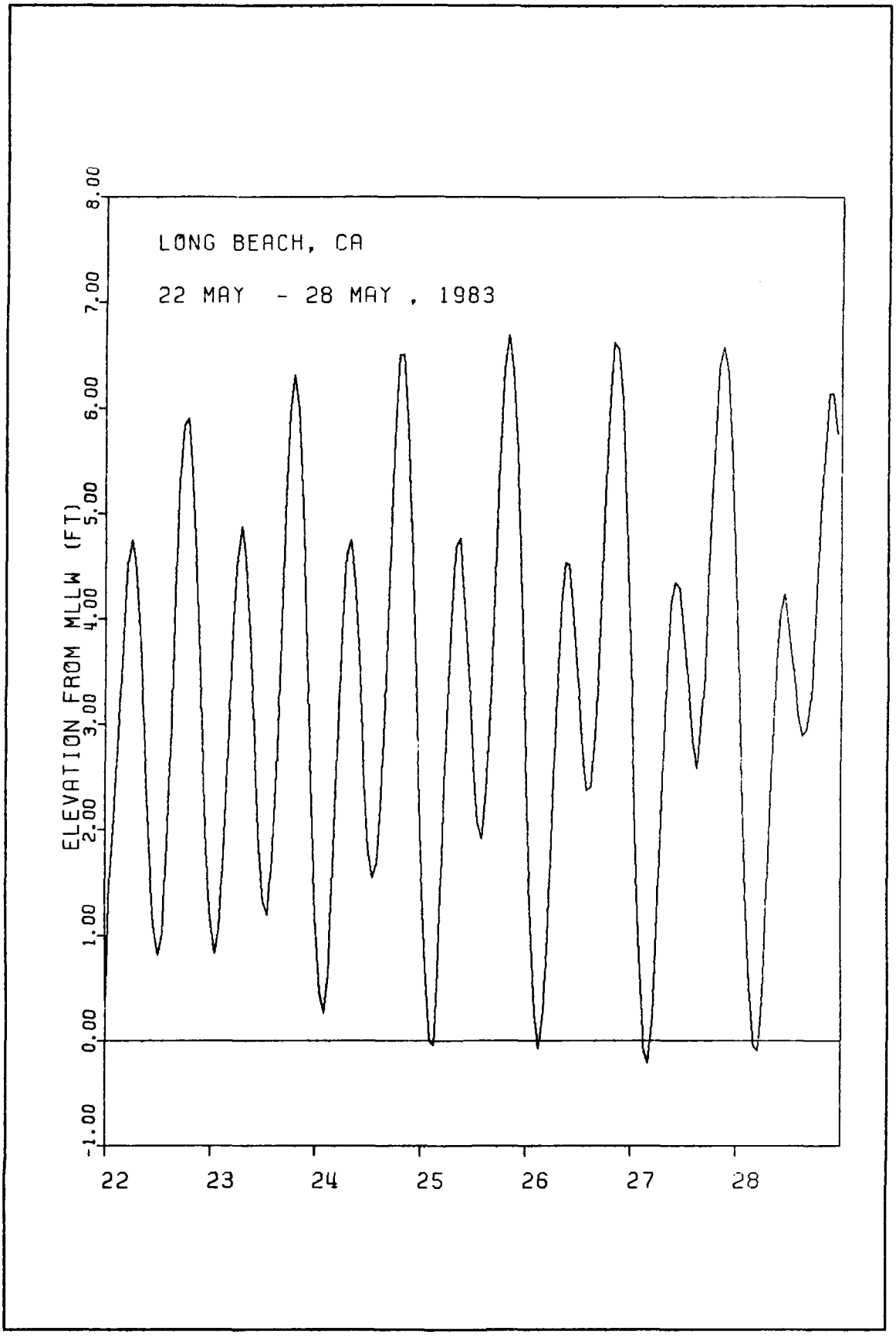

LOS ANGELES BERTH 60
22 JUNE - 28 JUNE , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
22
23
24
25
26
27
28

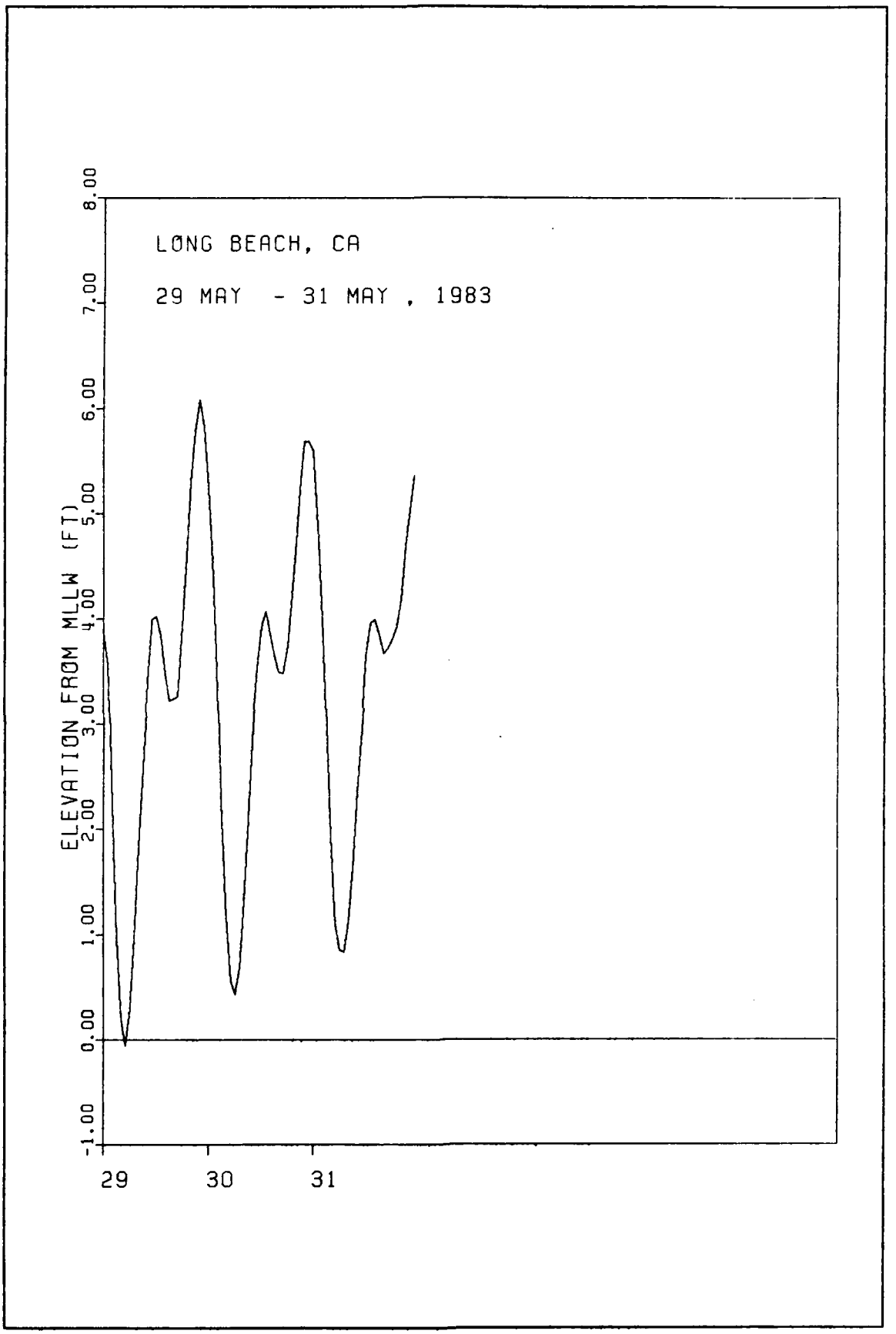

LOS ANGELES BERTH 60
29 JUNE - 30 JUNE , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
29
30

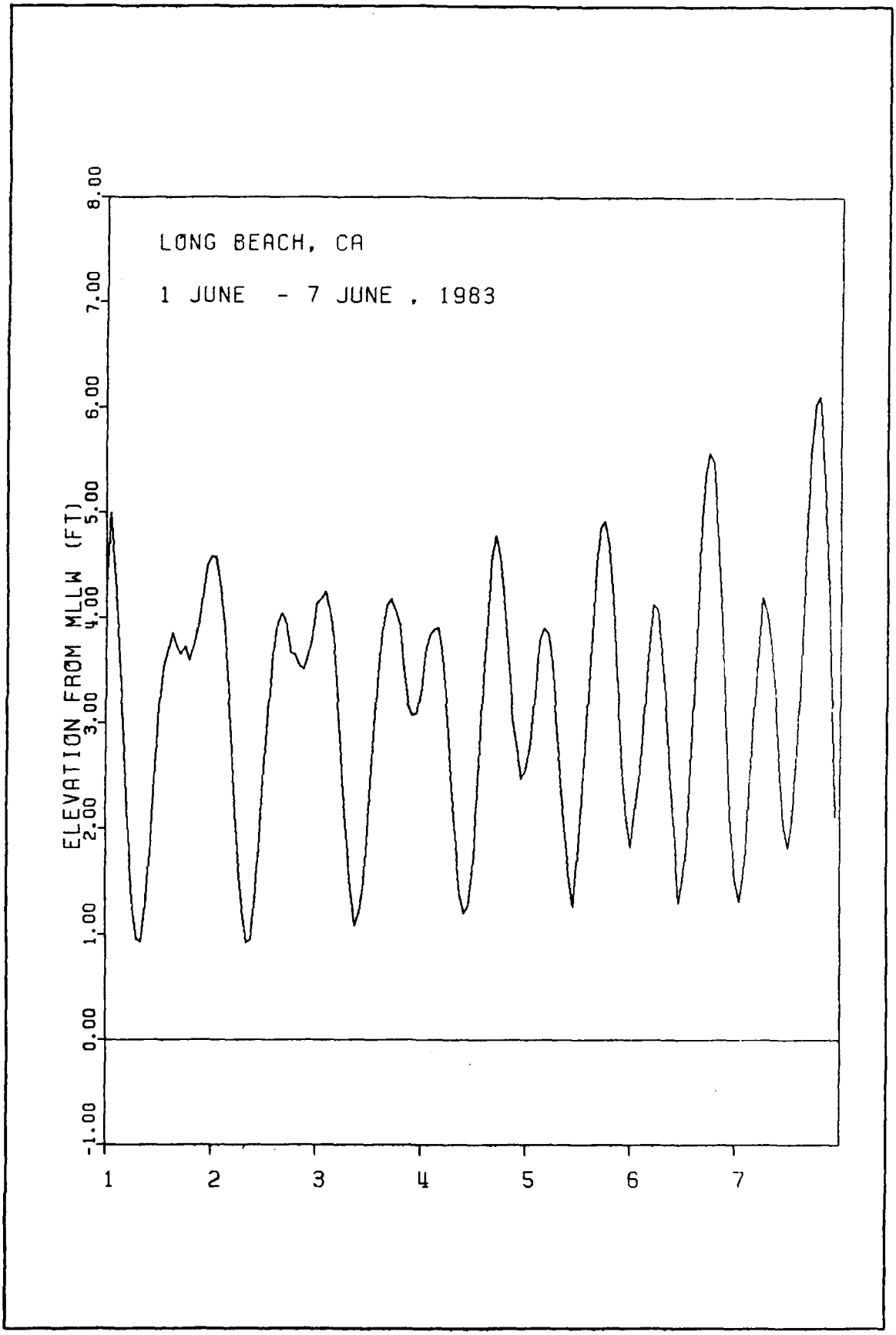

LONG BEACH, CA
1 MAY - 7 MAY , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
1
2
3
4
5
6
7

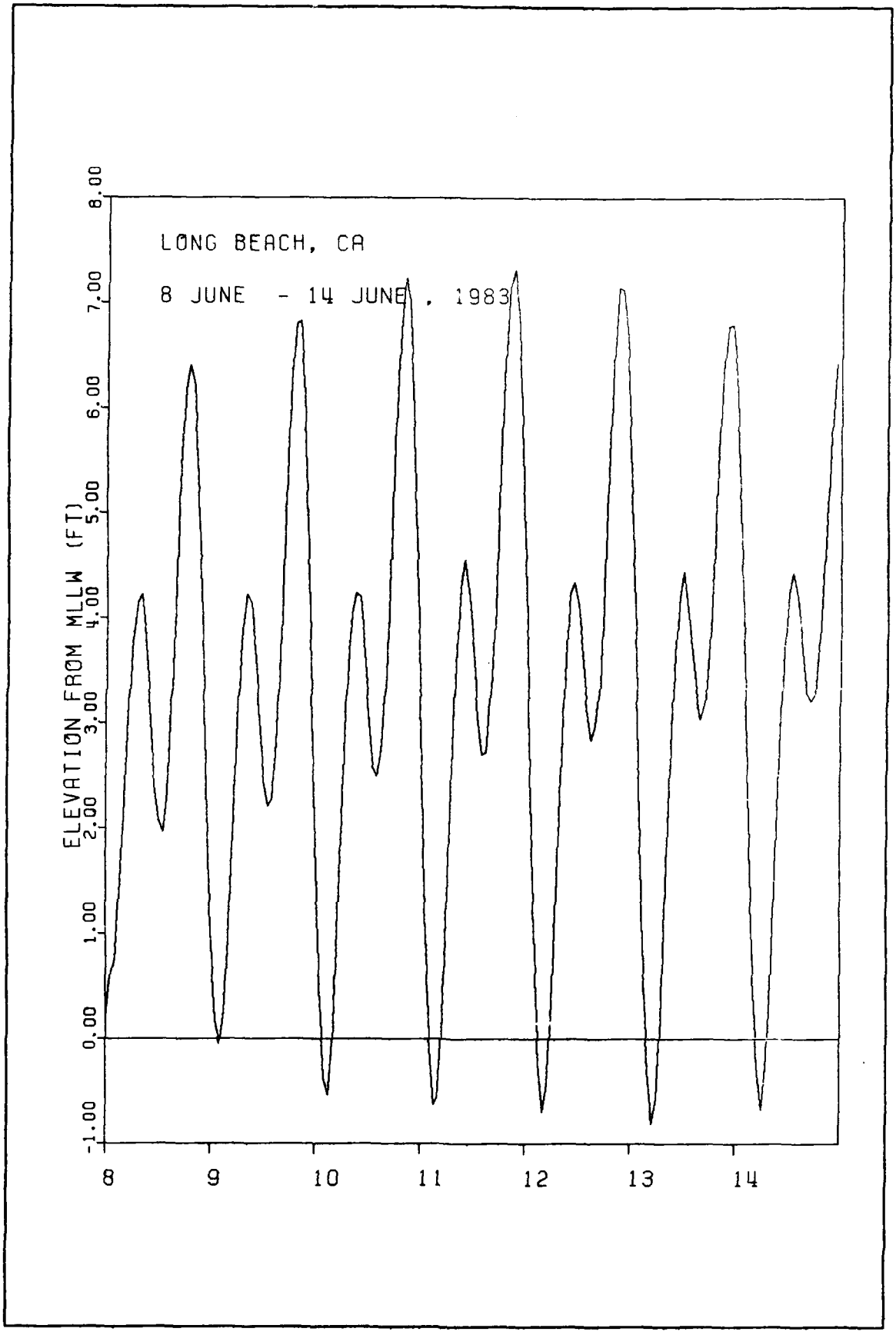

LONG BEACH, CA
8 MAY - 14 MAY , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
8
9
10
11
12
13
14

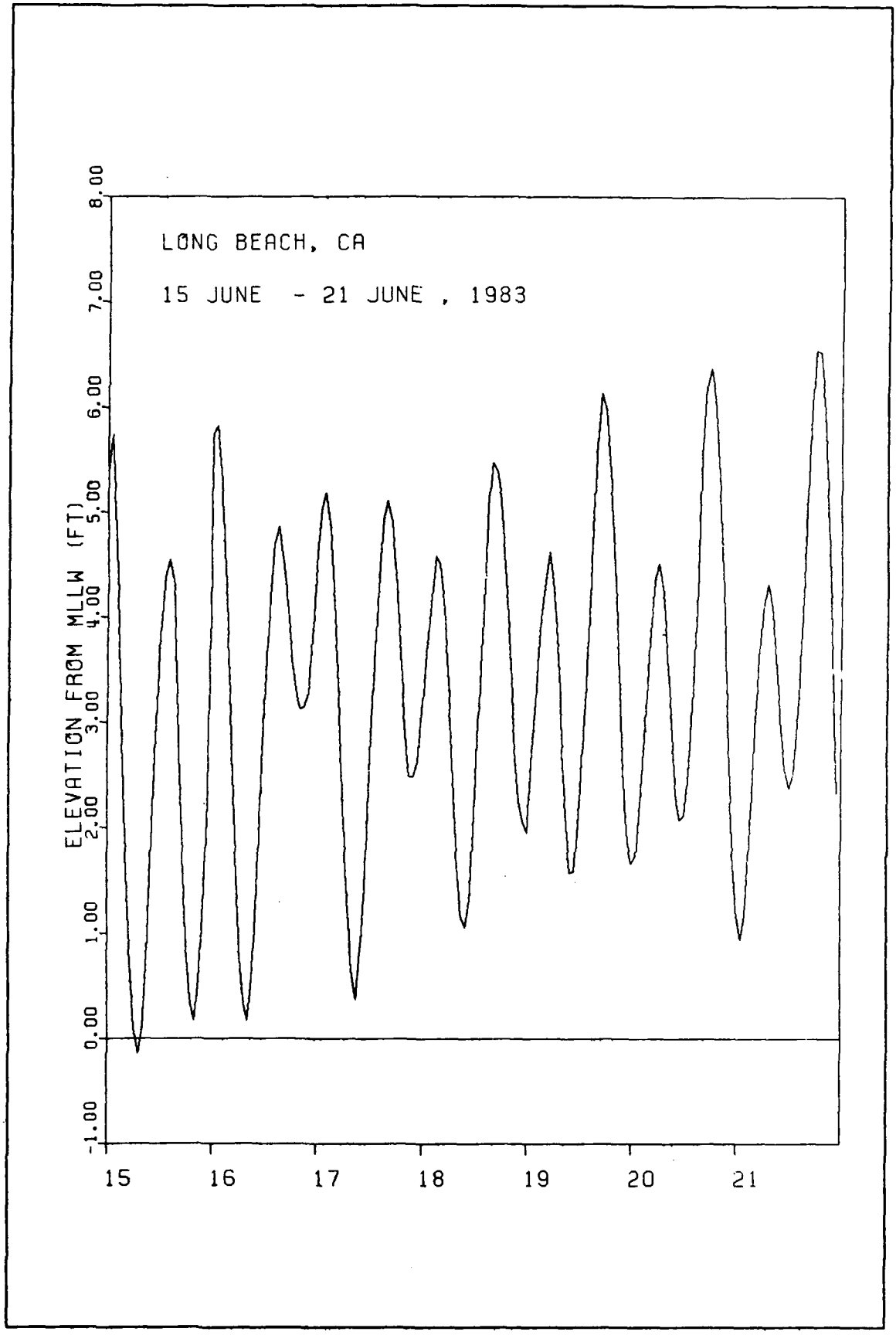

LONG BEACH, CA
15 MAY - 21 MAY , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
15
16
17
18
19
20
21

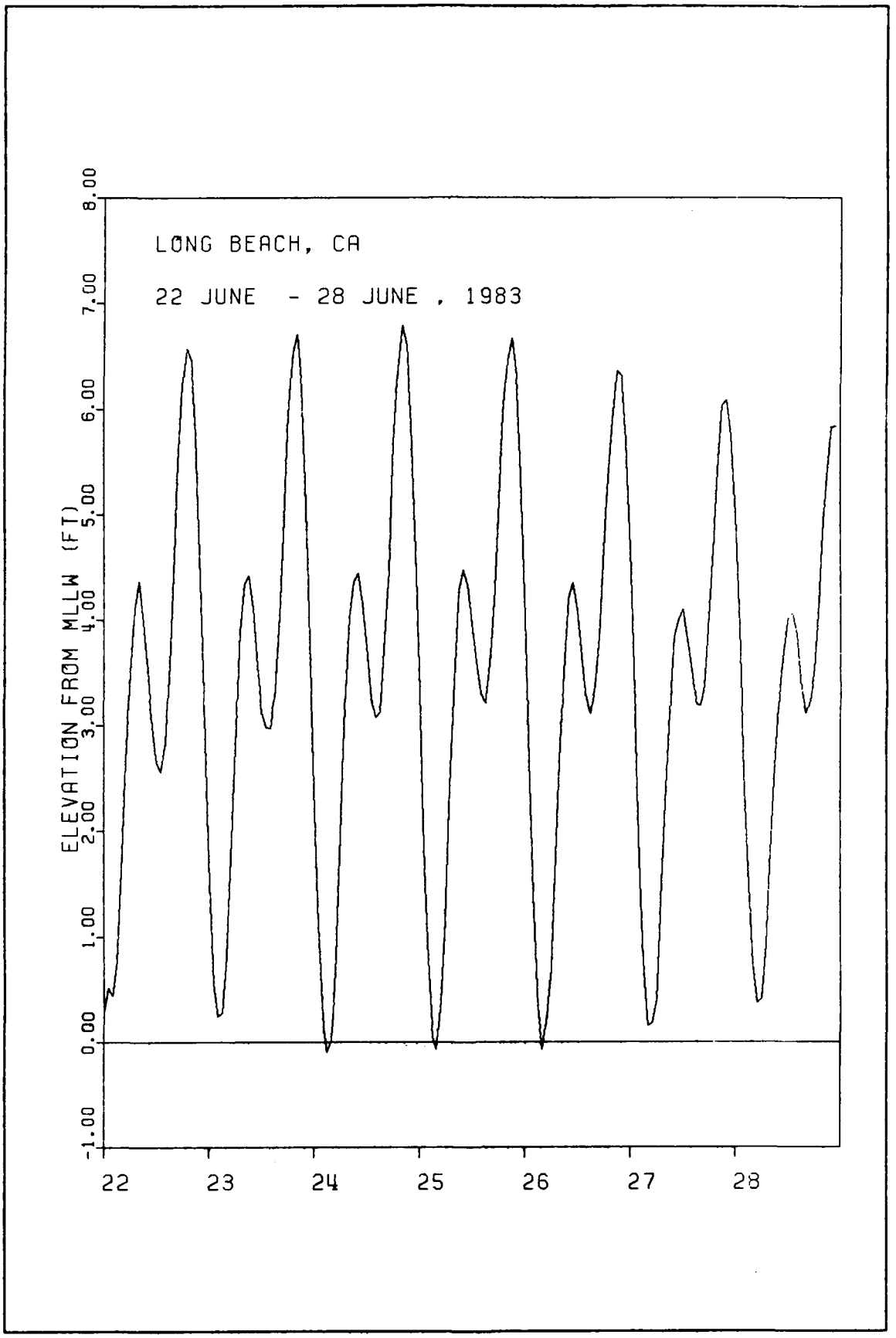

LONG BEACH, CA
22 MAY - 28 MAY , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
22
23
24
25
26
27
28

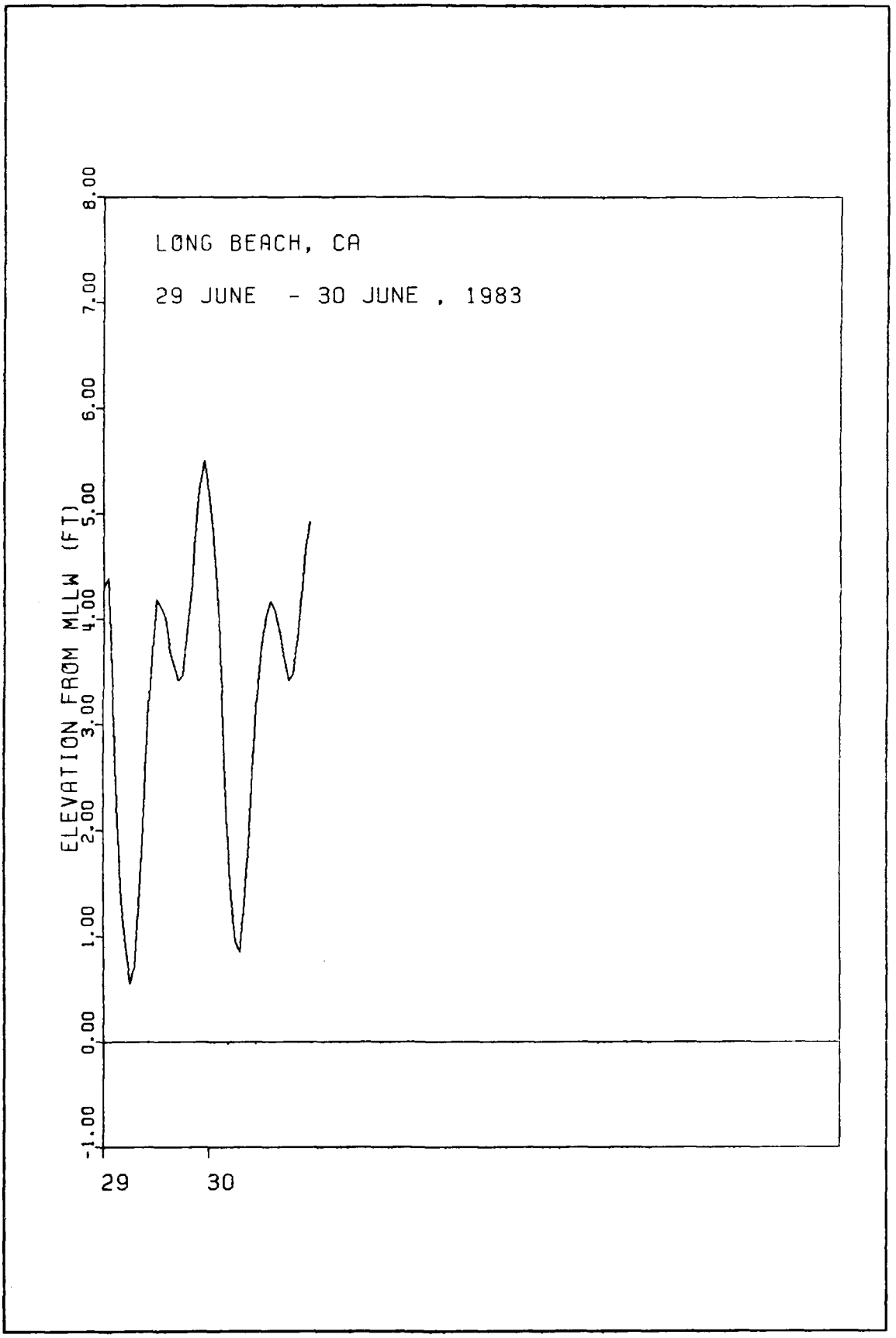

LONG BEACH, CA
29 MAY - 31 MAY , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
29
30
31


LONG BEACH, CA
1 JUNE - 7 JUNE , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
1
2
3
4
5
6
7

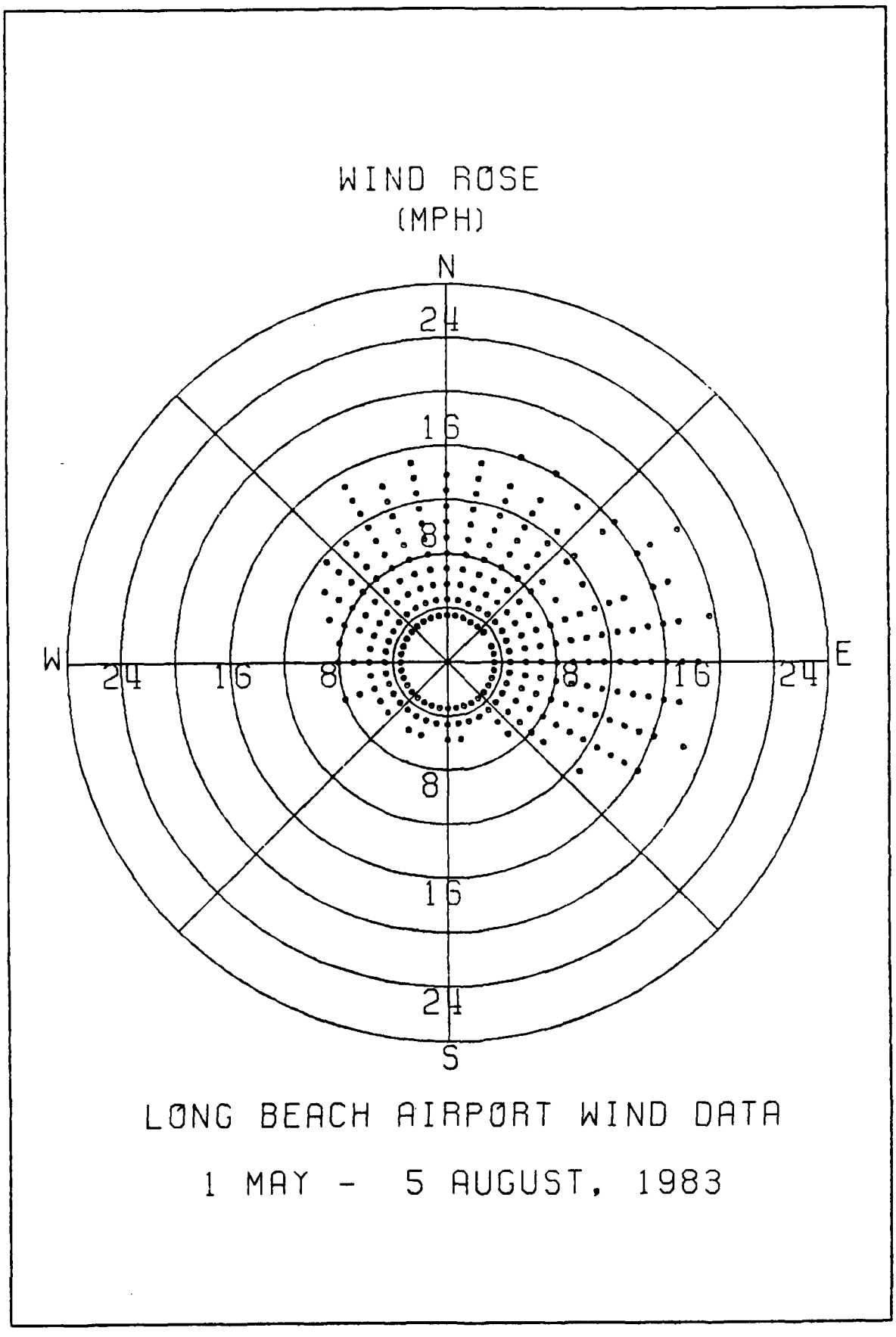

LONG BEACH, CA
8 JUNE - 14 JUNE , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
8
9
10
11
12
13
14

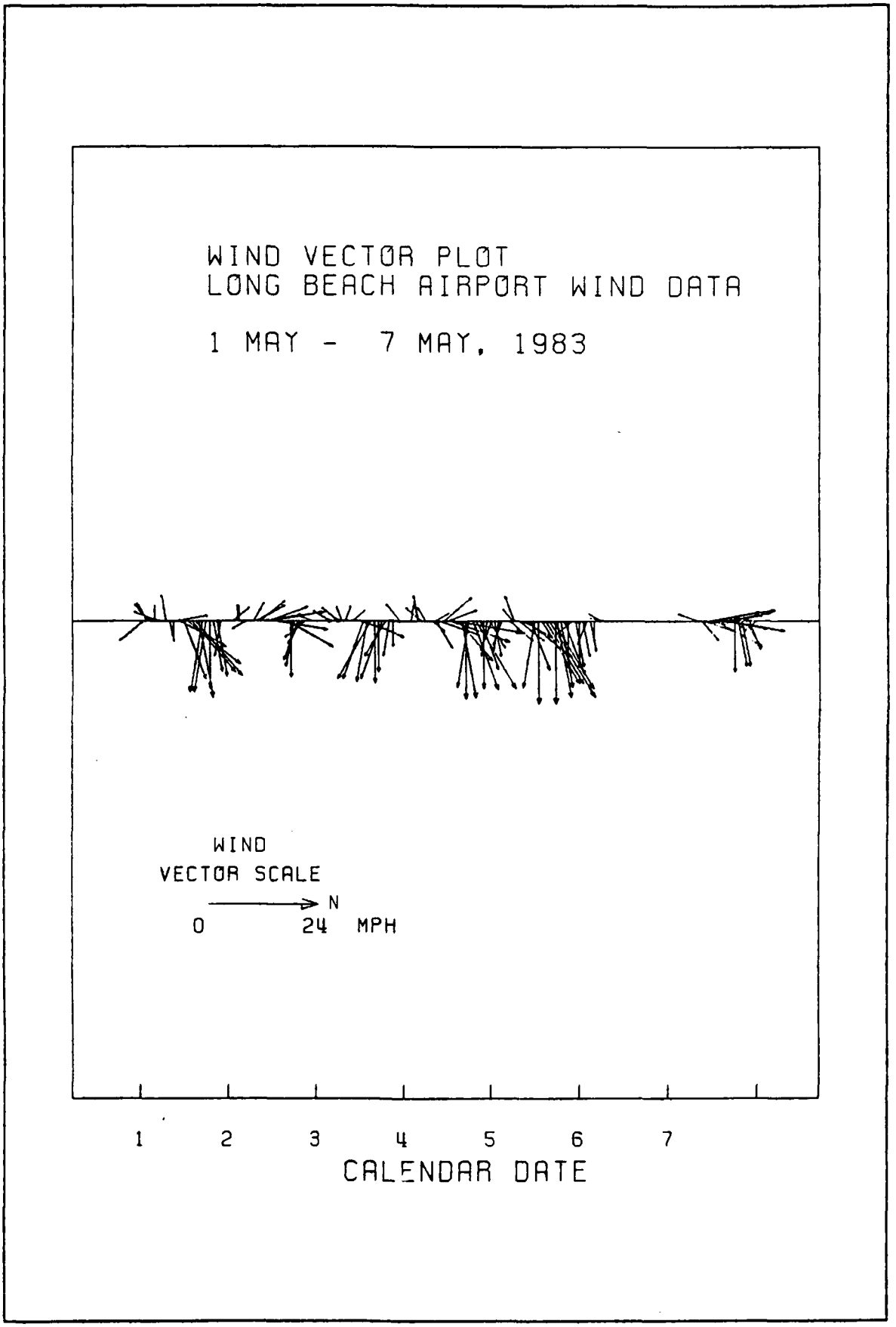

LONG BEACH, CA
15 JUNE - 21 JUNE , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
15
16
17
18
19
20
21

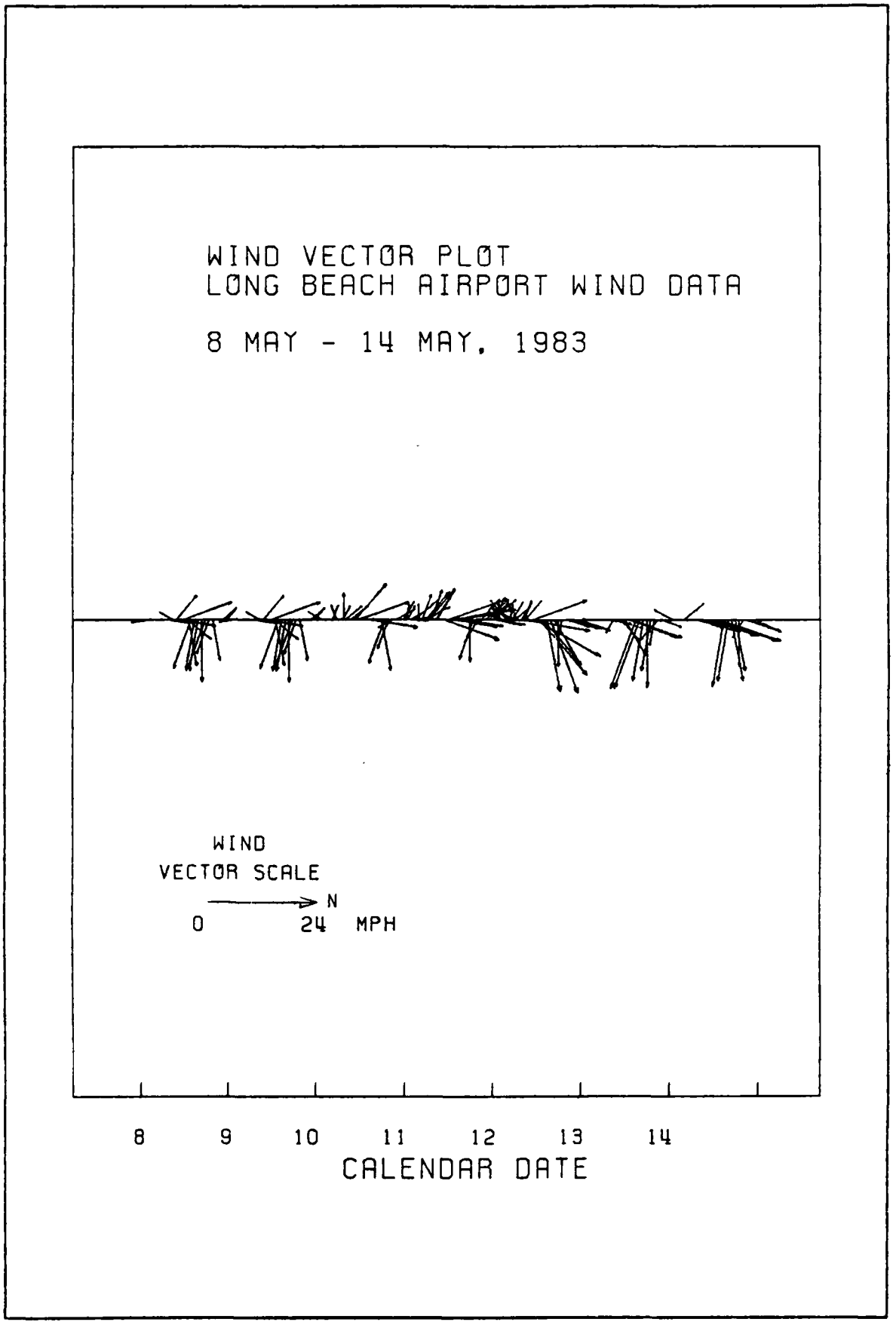

LONG BEACH, CA
22 JUNE - 28 JUNE , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
22
23
24
25
26
27
28

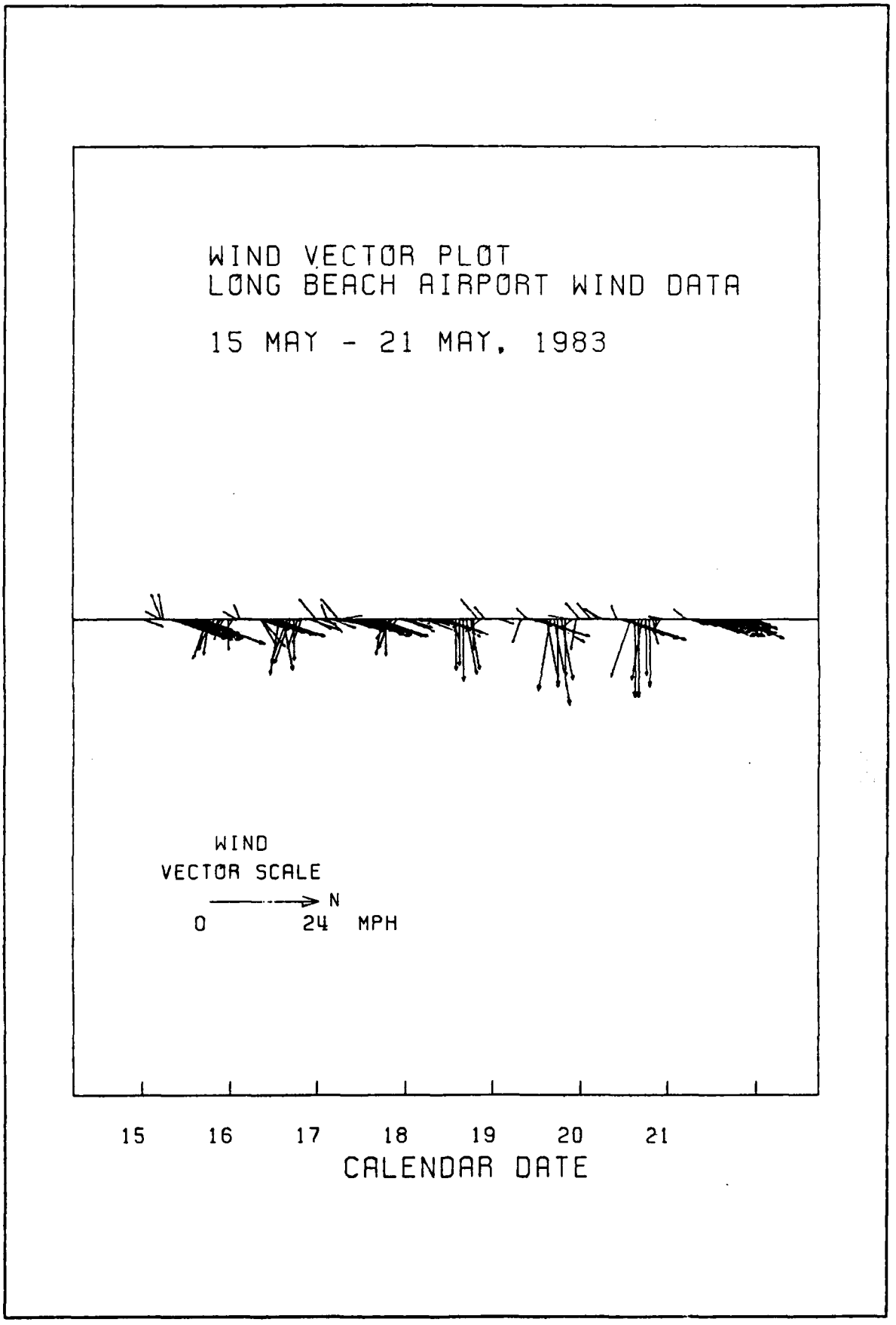

LONG BEACH, CA
29 JUNE - 30 JUNE , 1983
ELEVATION FROM MLLW (FT)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
29
30

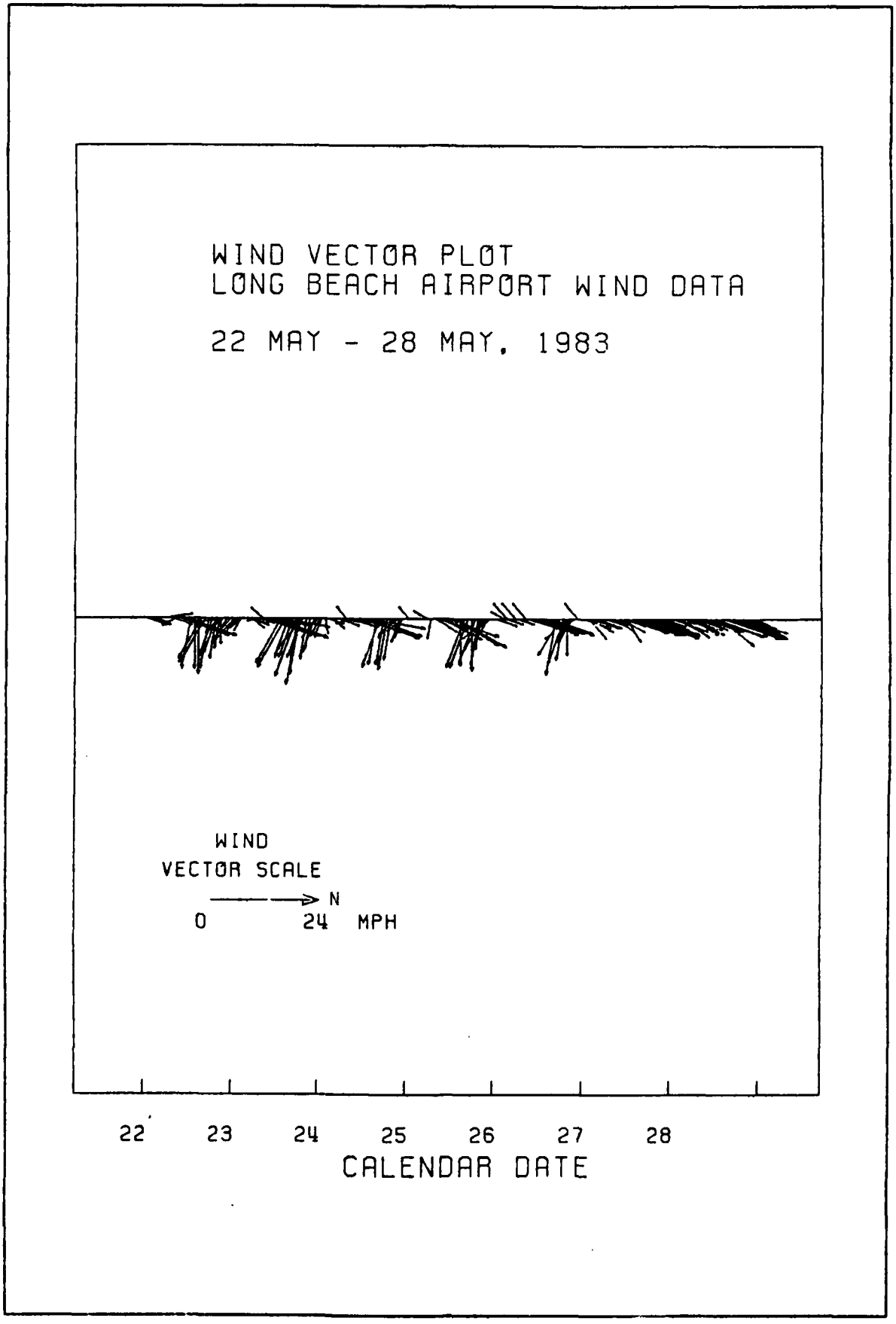
APPENDIX D: WIND DATA

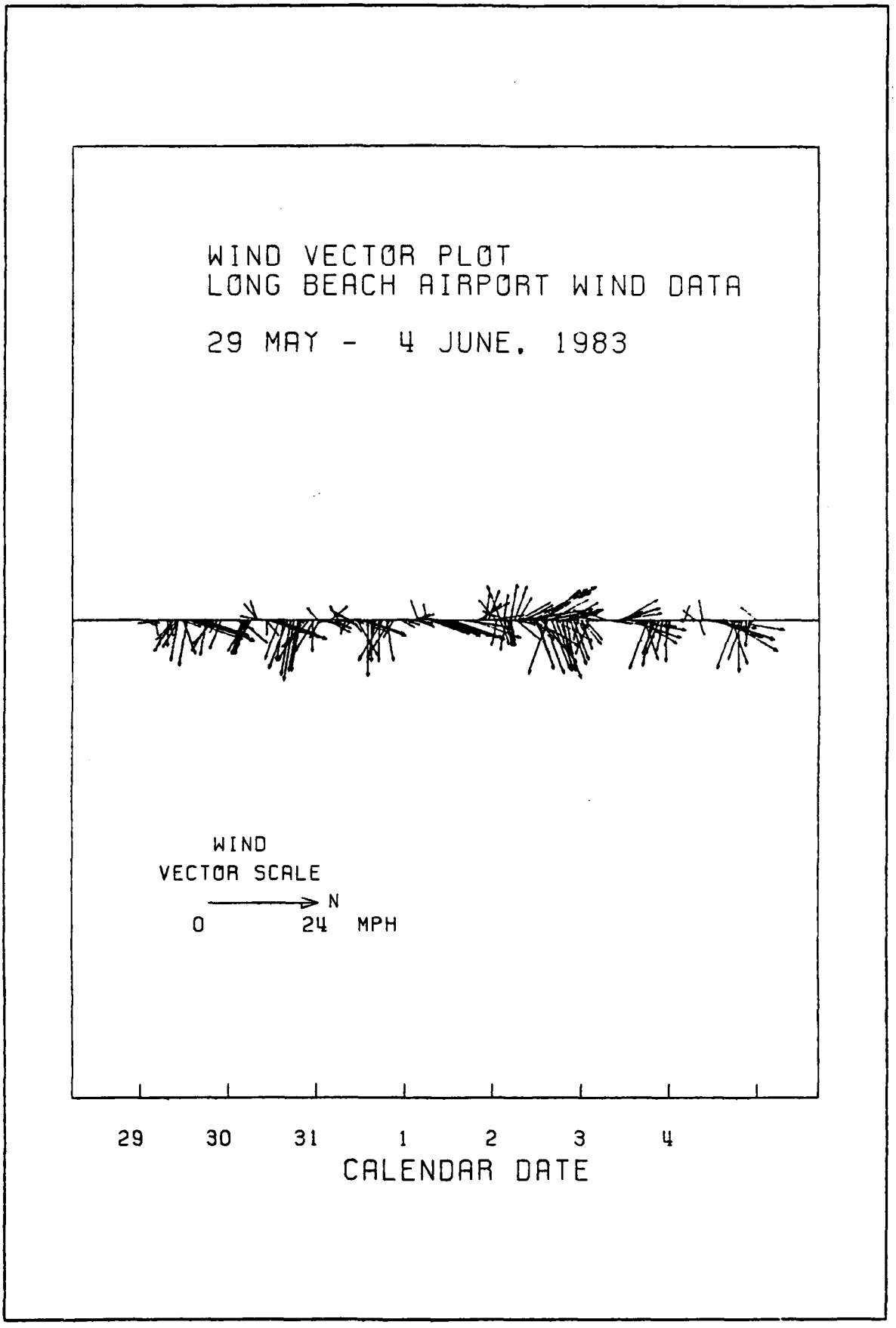

WIND ROSE
(MPH)
N
24
16
8
W
24
16
8
8
16
24
E
8
16
24
S
LONG BEACH AIRPORT WIND DATA
1 MAY - 5 AUGUST, 1983

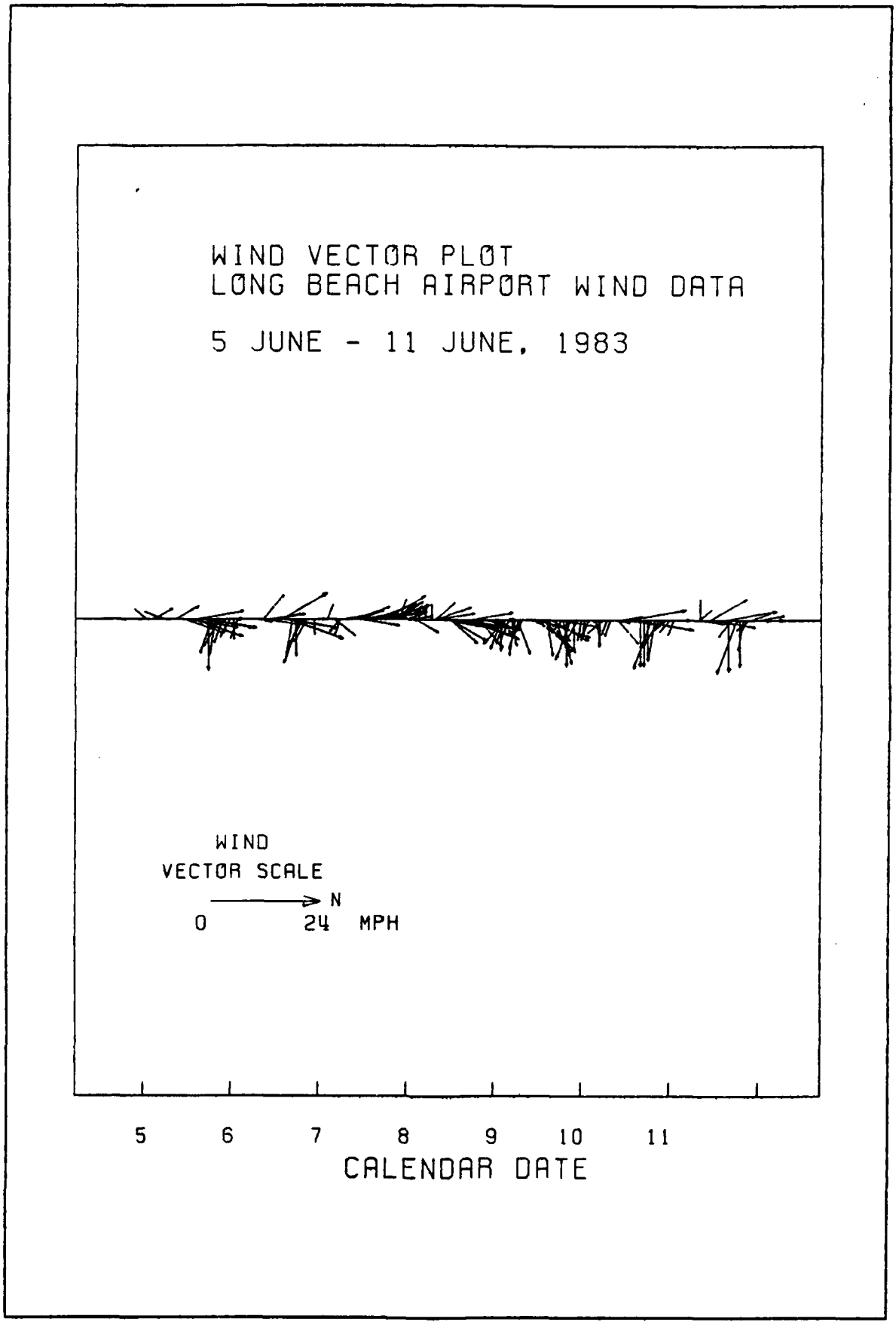

WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
1 MAY - 7 MAY, 1983
WIND
VECTOR SCALE
N
0
24 MPH
1
2
3
4
5
6
7
CALENDAR DATE

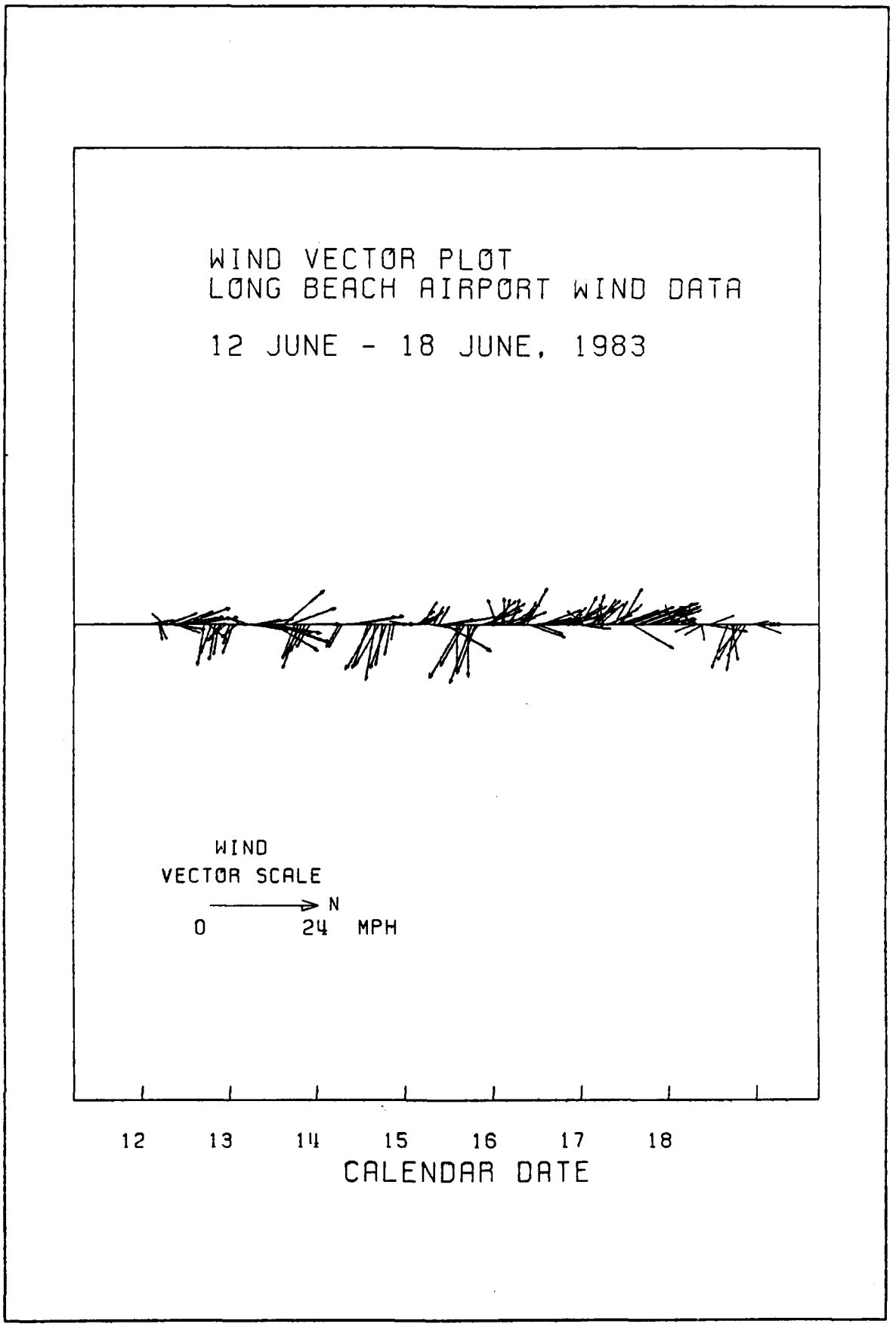

WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
8 MAY - 14 MAY, 1983
WIND
VECTOR SCALE
N
0
24 MPH
8
9
10
11
12
13
14
CALENDAR DATE

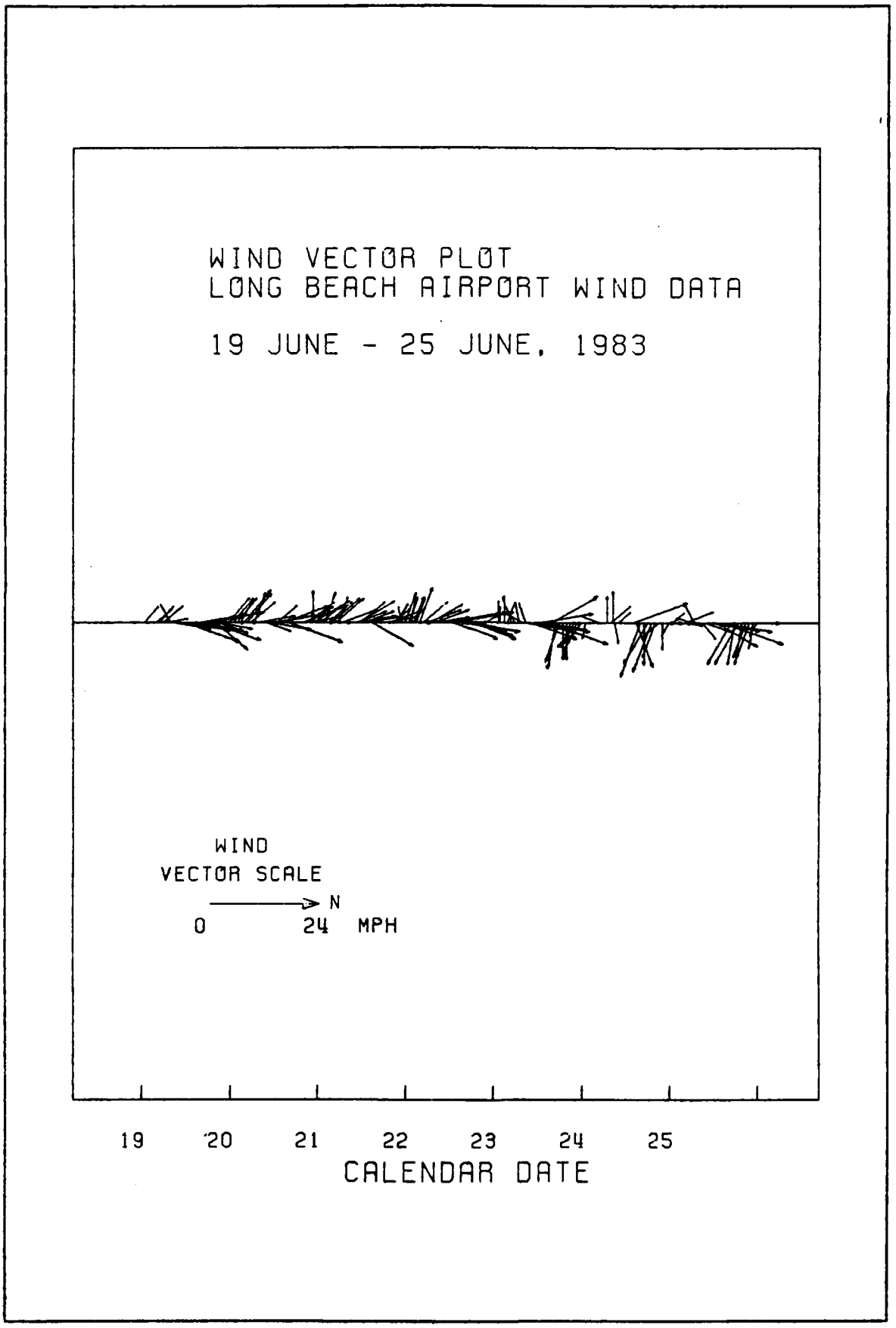

WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
15 MAY - 21 MAY, 1983
WIND
VECTOR SCALE
N
0
24 MPH
15
16
17
18
19
20
21
CALENDAR DATE

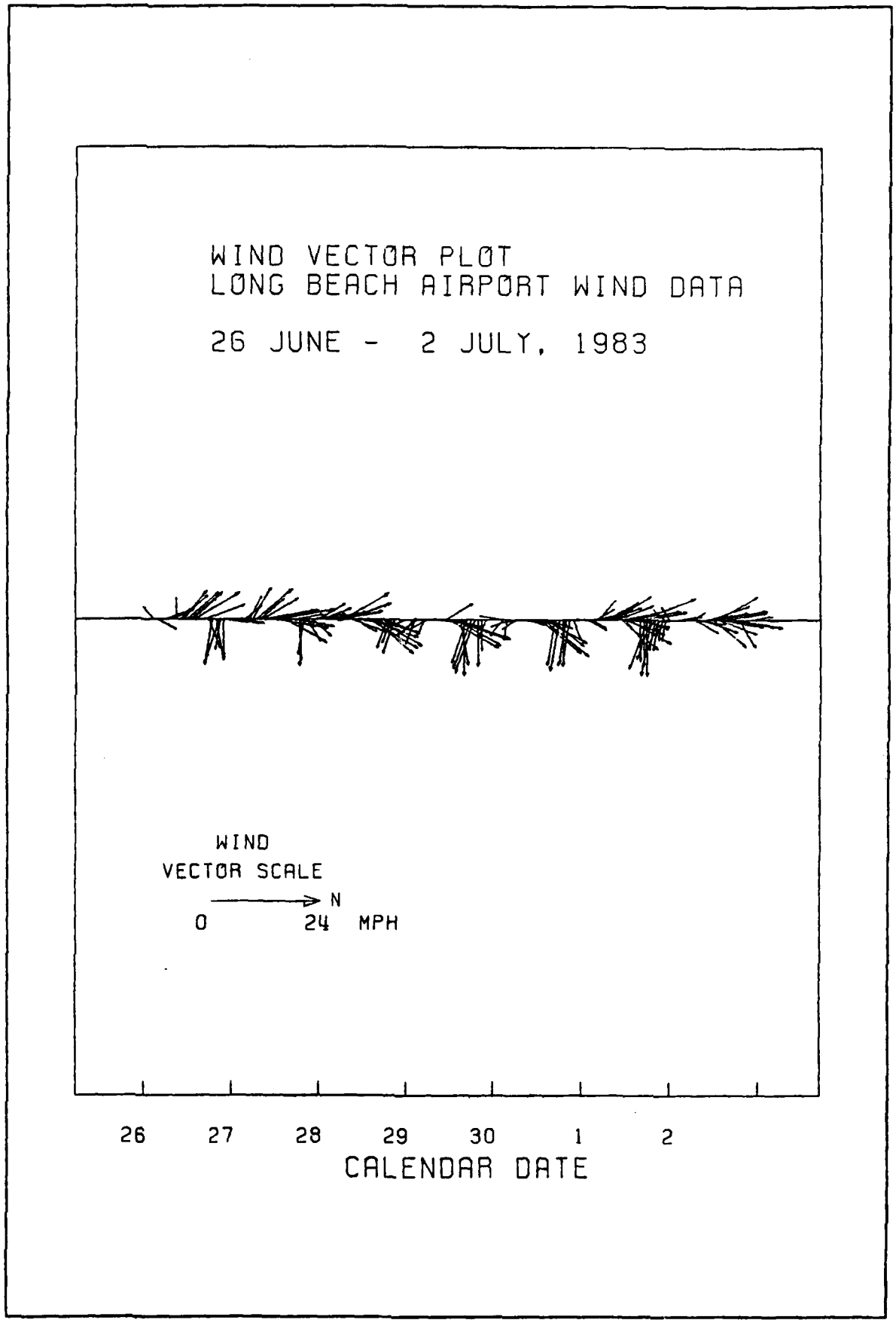

WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
22 MAY - 28 MAY, 1983
WIND
VECTOR SCALE
N
0
24 MPH
22
23
24
25
26
27
28
CALENDAR DATE

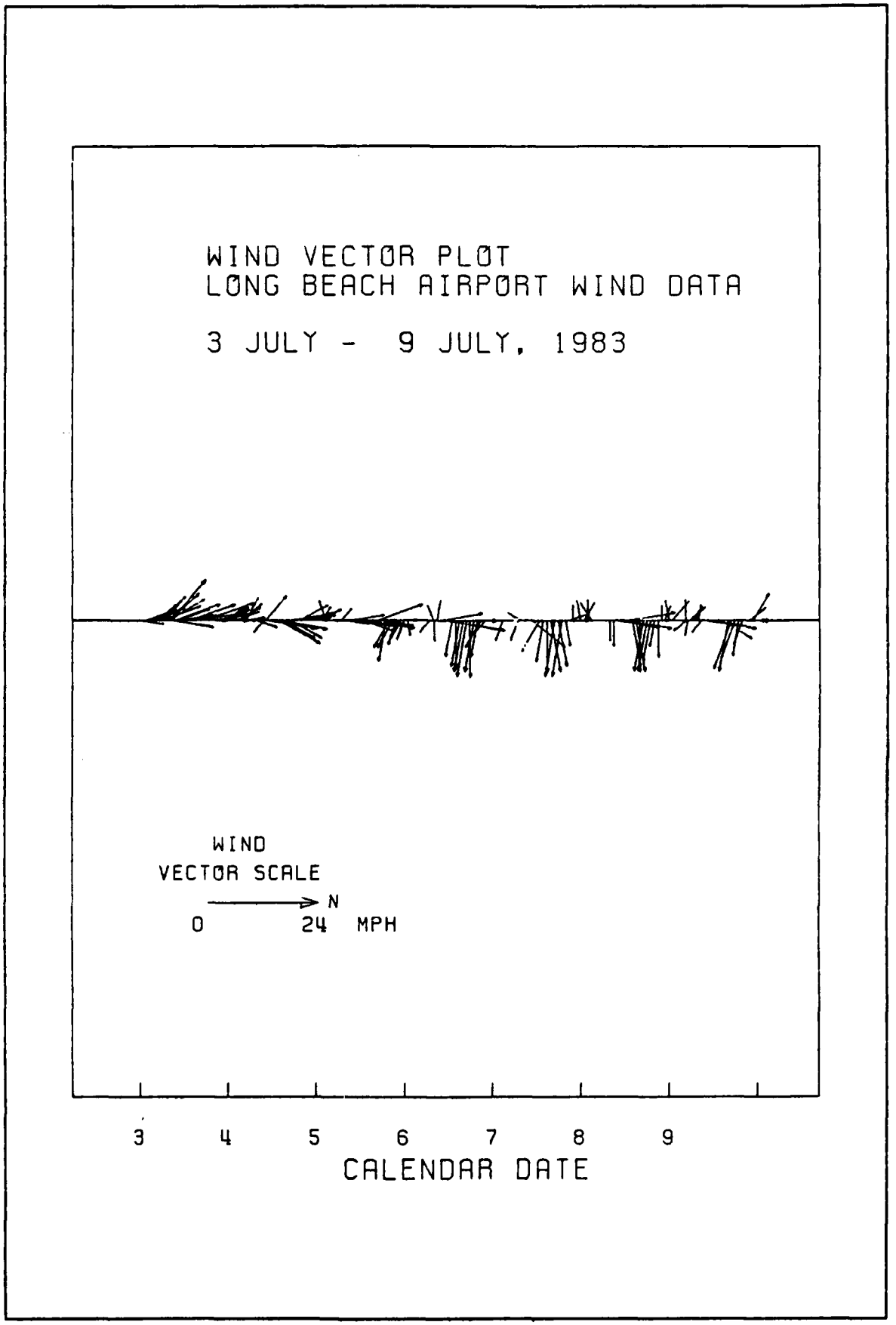

WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
29 MAY - 4 JUNE, 1983
WIND
VECTOR SCALE
N
0
24 MPH
29
30
31
1
2
3
4
CALENDAR DATE

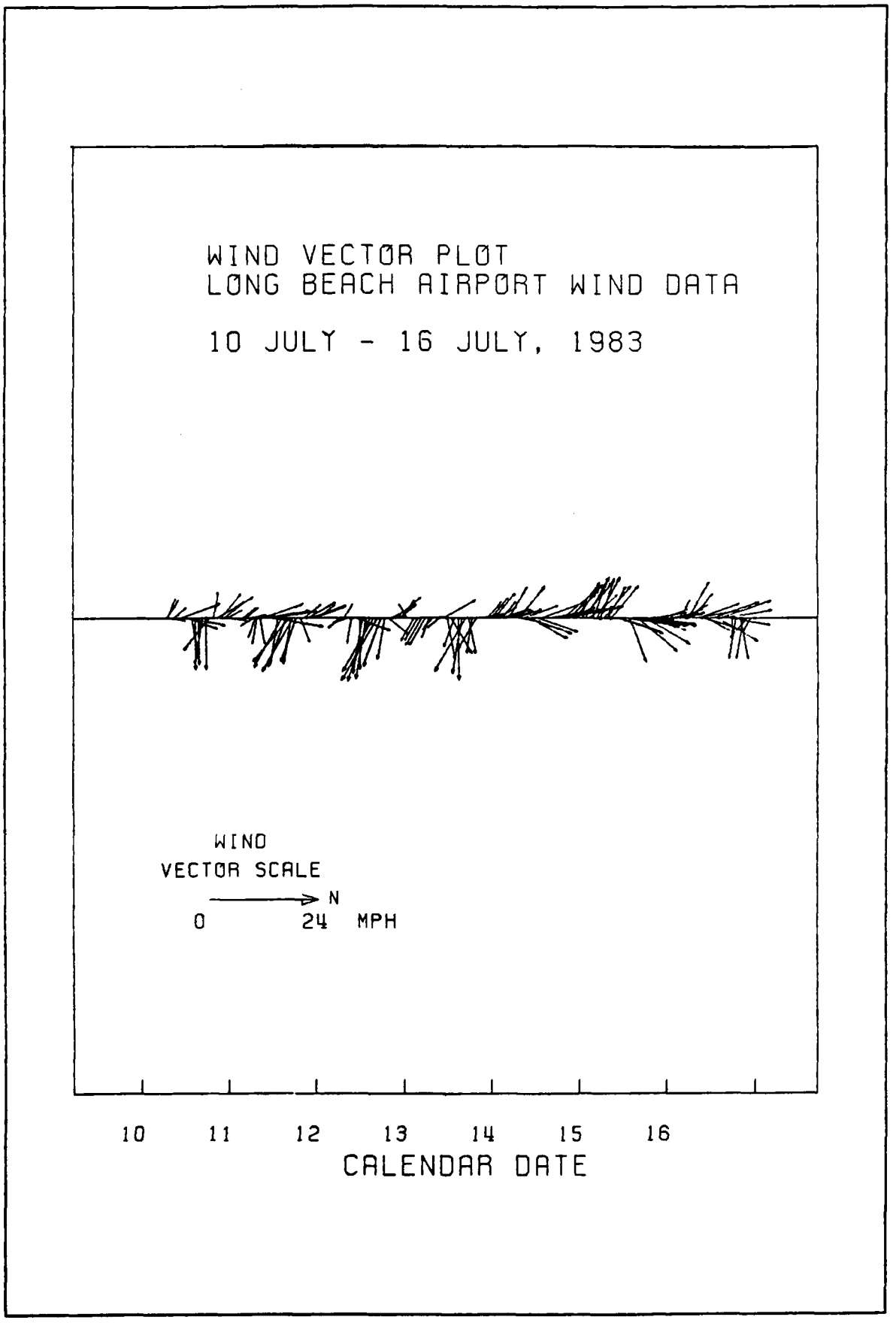

WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
5 JUNE - 11 JUNE, 1983
WIND
VECTOR SCALE
N
0
24 MPH
5
6
7
8
9
10
11
CALENDAR DATE

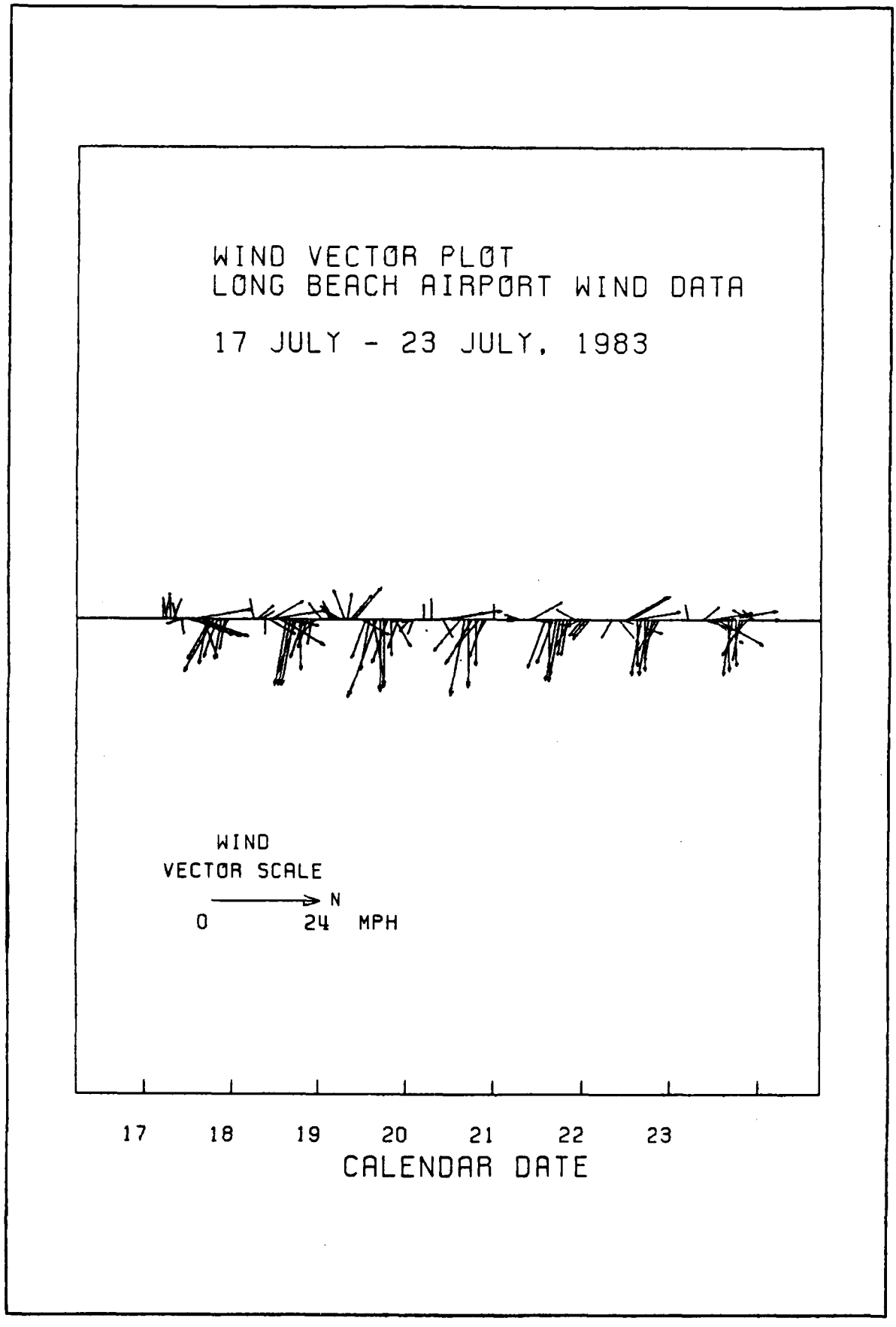

WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
12 JUNE - 18 JUNE, 1983
WIND
VECTOR SCALE
N
0
24 MPH
12
13
14
15
16
17
18
CALENDAR DATE

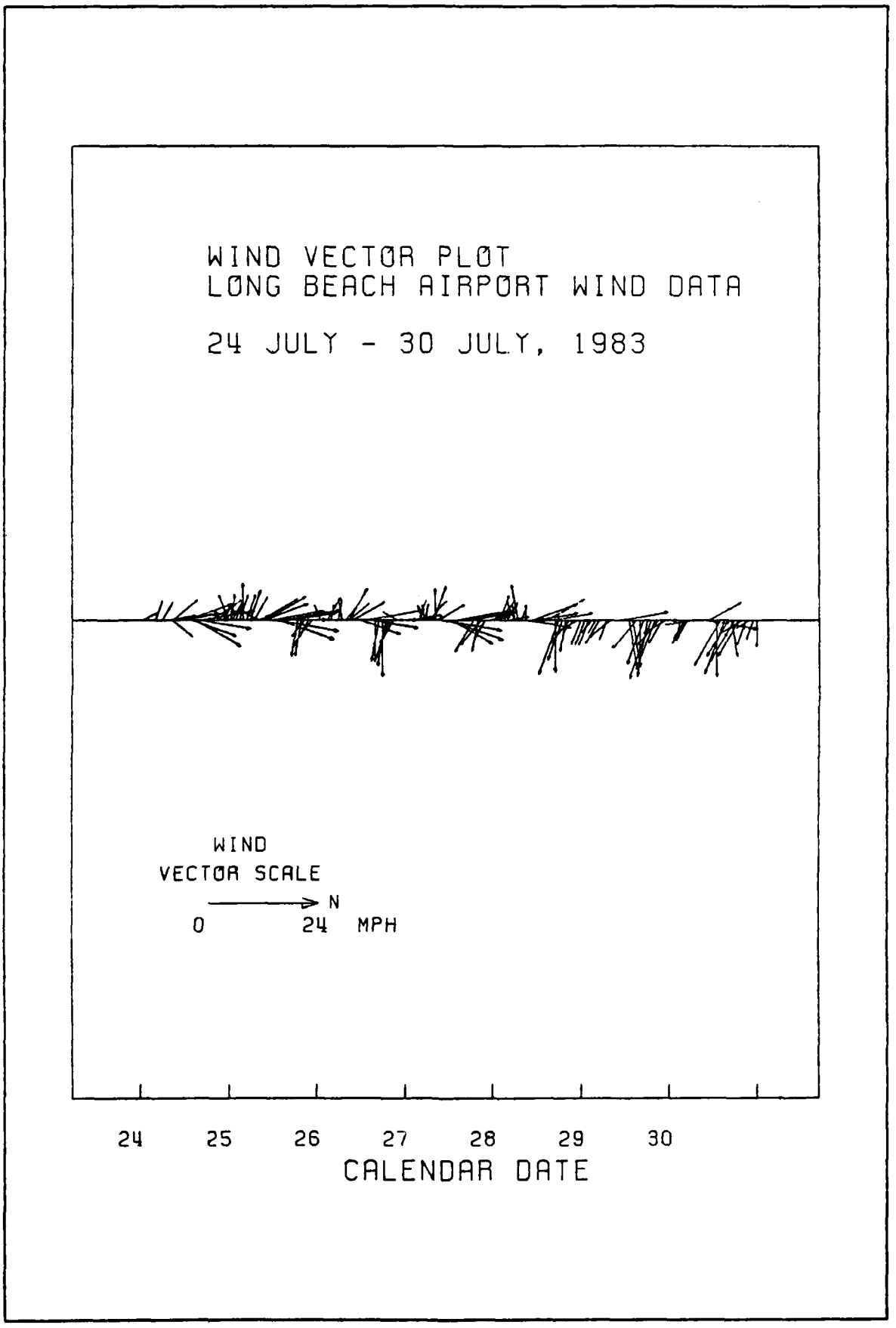

WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
19 JUNE - 25 JUNE, 1983
WIND
VECTOR SCALE
N
0
24 MPH
19
20
21
22
23
24
25
CALENDAR DATE

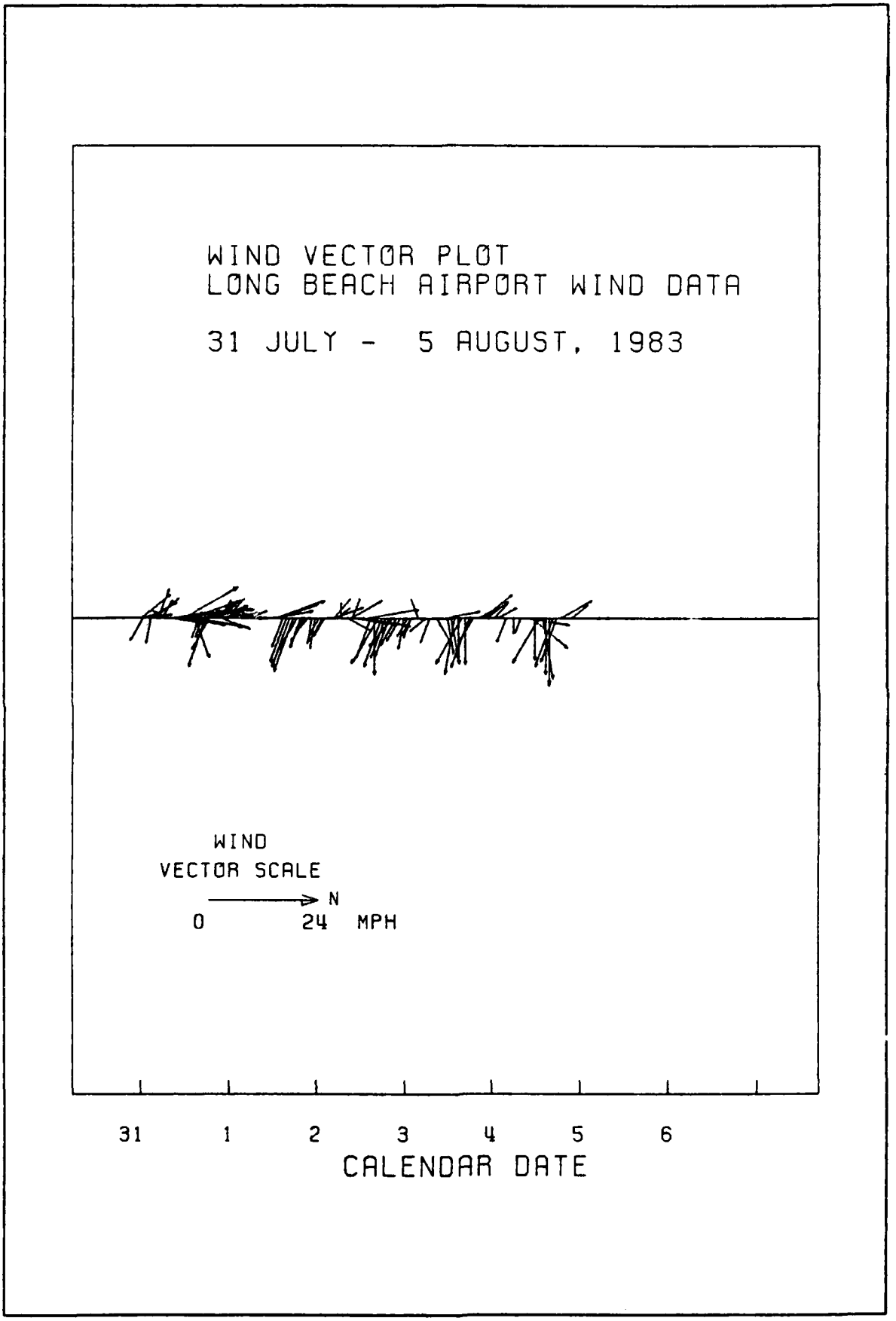

WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
26 JUNE - 2 JULY, 1983
WIND
VECTOR SCALE
N
0
24 MPH
26
27
28
29
30
1
2
CALENDAR DATE


WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
3 JULY - 9 JULY, 1983
WIND
VECTOR SCALE
N
0
24 MPH
3
4
5
6
7
8
9
CALENDAR DATE


WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
10 JULY - 16 JULY, 1983
WIND
VECTOR SCALE
N
0
24 MPH
10
11
12
13
14
15
16
CALENDAR DATE


WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
17 JULY - 23 JULY, 1983
WIND
VECTOR SCALE
N
0
24 MPH
17
18
19
20
21
22
23
CALENDAR DATE


WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
24 JULY - 30 JULY, 1983
WIND
VECTOR SCALE
N
0
24 MPH
24
25
26
27
28
29
30
CALENDAR DATE


WIND VECTOR PLOT
LONG BEACH AIRPORT WIND DATA
31 JULY - 5 AUGUST, 1983
WIND
VECTOR SCALE
N
0
24 MPH
31
1
2
3
4
5
6
CALENDAR DATE